THE

# AGRICULTURAL GAZETTE

. . OF . .

# NEW SOUTH WALES.

Issued by Direction of

THE HON. JOHN KIDD, M.P.

Secretary for Mines and Agriculture.

VOL. XIV.

EDITED BY W. H. CLARKE.

By Authority:

SYDNEY: W. A. GULLICK, GOVERNMENT PRINTER.

**Registered under the Copyright Act, 1879.**

*It is hereby notified that all matter contained in the* Agricultural Gazette of New South Wales *is protected by copyright. Newspapers desirous of republishing any articles may do so, and are merely required to make the usual acknowledgment.*

*4th June, 1894.*

# CONTENTS.

## JANUARY.

PAGE.
"White Scour" and "Lung Disease" in Calves J. D. Stewart 1
Vitality of Parsnip Seed ... ... ... ... ... ... 10
Sheep for the Farmer ... E. D. E. Van Weenen ("Lana") 11
Apricot Pulp ... ... ... ... ... ... W. J. Allen 14

Diseases in Sheep—

Stranguary (Ulcerated Sheath) in Male Sheep W. G. Dowling 15
Fodder Plants ... ... ... ... ... ... "Bush Native" 17
Woolly Aphis, or American Blight ... W. W. Froggatt 18
Effect of Engine-boiler Steam on the Vitality of Seeds and Spores .. ... ... ... ... ... N. A. Cobb 26
Condensed Milk ... ... ... ... M. A. O'Callaghan 30
Seed Wheat ... ... ... ... ... ... N. A. Cobb 33
Irrigation in the Western Division ... ... J. Wright 51
The Stability of the Colouring Matter in Red Wines M. Blunno 55
Dairying—Notes and News... ... ... M. A. O'Callaghan 63

Hawkesbury Agricultural College and Experimental Farm—

Construction of Pig-stye Buildings ... ... A. Brooks 65
Hawkesbury District Farm Notes... ... ... H. W. Potts 81

Farm Notes—

Bathurst District ... ... ... ... R. W. Peacock 84
Riverina District ... ... ... .. G. M. McKeown 85
Orchard Notes ... ... ... ... ... ... W. J. Allen 86
Green Food for Farm Horses ... ... ... ... ... 87
Practical Vegetable and Flower Growing W. S. Campbell 89
London Dairy Show ... ... ... ... ... ... 90
General Notes ... ... ... ... ... ... ... ... 91
Curing and Stacking Cowpea-Vine Hay; Fleas.
Market Review ... ... .. ... ... ... ... ... 94
The Cow Pea for Dairy Farmers ... ... Geo. L. Sutton 96
List of Agricultural Societies' Shows.
Government Stud Bulls available for Lease or for Service at State Farms.

## FEBRUARY.

PAGE.

Means to Ameliorate the Conditions of Arid Regions—

Review of Book ... ... ... ... ... F. H. Newell 97

Fluctuations of Rainfall; Grazing Lands; Requirements for Water Storage; Methods of Irrigation; Amount of Water required for crops.

Artesian Water from Goodooga Bore ... ... ... ... 110

Drought Fodder ... ... ... ... A. G. Humby 111

A Good Cabbage... ... ... ... ... ... ... ... 113

Pot Experiments to Determine the Limits of Endurance of Different Crops for certain Injurious Substances. F. W. Guthrie and R. Helms 114

New Breeds and Varieties of Fowls—

Anconas as Egg Producers ... ... ... Geo. Bradshaw 121

Bottling Apples ... ... ... ... ... W. J. Allen 126

About Eggs ... ... ... ... ... ... Geo. Bradshaw 127

The Stability of the Colouring Matter in Red Wines. M. Blunno 135

Controlling Temperature of Wine Fermentation; the Guilleband Wine Cooler in Practice.

Soil Deterioration and Erosion ... ... ... H. V. Jackson 139

Special Prize for Best Collection of New South Wales Commercial Timbers ... ... ... ... ... ... 144

Seed Wheat (*continued*) ... ... ... ... N. A. Cobb 145

A Handy Horse-power ... ... ... ... ... N. A. Cobb 170

Hawkesbury Agricultural College—

Maize Ensilage ... ... ... ... ... H. W. Potts 171

Farm Notes—Hawkesbury District ... ... H. W. Potts 173

Potatoes Sprouting in the Ground ... ... ... ... 174

Sorghum Hay ... ... ... ... ... ... ... ... 175

Farm Notes—

Bathurst District ... ... ... ... R. W. Peacock 177

Riverina District ... ... ... ... G. M. McKeown 178

Orchard Notes ... ... ... ... ... ... W. J. Allen 179

Analysis of Field Peas and Tares, or Vetches, used for Green Manure in the Orchard... ... ... ...F. B. Guthrie 180

PAGE.
PRACTICAL VEGETABLE AND FLOWER GROWING W. S. Campbell 182
OPENINGS FOR PRESERVED FRUIT ... ... ... ... ... 185
THINNING TOMATOES TO INCREASE SIZE OF FRUIT... ... ... 187
MARKET REVIEW... ... ... ... ... ... ... ... ... 188
AGRICULTURAL SOCIETIES' SHOWS ... ... ... ... ... 192

## MARCH.

SEED WHEAT ... ... ... ... ... ... N. A. Cobb 193
Size of Grain; Conserving Seed for future use; the Grading of Seed Wheat; Grading Machinery; Conclusions.

BUNT EXPERIMENTS OF 1901 ... ... ... ... W. Farrer 206
Results of treatment with solution of bluestone; solution of formalin; solution of corrosive sublimate.

THE QUANTITY OF WHEAT TO SOW PER ACRE R. W. Peacock 217

GROWING KURRAJONG TREES FROM SEED ... ... J. H. Maiden 220

CONDENSED MILK ... ... ... ... M. A. O'Callaghan 221
Condensed *v.* Concentrated Milk; Boric Acid; Composition of Condensed Milks; Technique of Manufacture.

DAIRY NOTES ... ... ... ... ... M. A. O'Callaghan 227
Fifth State Butter Show—Points awarded to competing butters; faults in manufacture; examples of packing; effects of temperature; bacteriological illustrations of a butter which kept well and was awarded a prize, and of a butter which deteriorated in storage.
Cheese *versus* Butter ... ... ... ... ... ... 233
Notes and News ... ... ... ... ... ... ... 235

CALF STALL FEEDERS ... ... ... ... ... P. Quirk 239

USEFUL AUSTRALIAN PLANTS ... ... ... ... J. H. Maiden 241
No. 82—*Panicum helopus*, Trin.

THE EXPORT OF PRIZE MUTTON ... ... ...H. V. Jackson 242
N.S.W. Sheepbreeders' Association Show, 1902.

BEE MATTERS ... ... ... ... ... ... Albert Gale 247
Care of New Swarms; Bee appliances—Wire Section-cradles.

MANURES FOR PASSION VINES ... ... ... ... ... ... 252
Experiments at Glenorie.

MAKING UNFERMENTED WINE ... ... ... ... M. Blunno 256

HAWKESBURY AGRICULTURAL COLLEGE—

PAGE.
The Use of Plants for checking Water Evaporation...C. T. Musson 257
An Experiment for Farmers ... ... Geo. L. Sutton 258
Results of an experiment to determine the needs of the soil, conducted on the farm of Mr. Percival, Clarendon.
Seed of *Paspalum dilatatum* ... ... ... C. T. Musson 262
Hawkesbury District ... ... ... ... H. W. Potts 264
Paspalum Grass at Hawkesbury Agricultural College ... 267

FARM NOTES—

Bathurst District ... ... ... ... R. W. Peacock 269
Riverina District ... ... ... ... G. M. McKeown 270
LEMON TREES LOSING THEIR LEAVES... ... ... J. Alford 272
ORCHARD NOTES ... ... ... ... ... ... ... W. J. Allen 273
A NEW MACHINE FOR CRUSHING APPLES FOR CIDER ... ... 275
PRACTICAL VEGETABLE AND FLOWER GROWING W. S. Campbell 276
MORE ABOUT EGGS ... ... ... ... Geo. Bradshaw 279
GENERAL NOTES ... ... ... ... ... ... ... ... 283
Coffee-growing on the Clarence; Experiments in the Destruction of Grasshoppers; Destruction of Sparrows.
AGRICULTURAL SOCIETIES' SHOWS ... ... ... ... ... 288

## APRIL.

THE MURRAY WATERS ... ... ... ... ... ... ... ... 292
From the Report of the Royal Commission, 1902.
CO-OPERATION AMONGST DUTCH MARKET GARDENERS ... ... 310
ANALYSES OF COMMERCIAL FERTILISERS IN N.S.W.: 1903 LIST ... 313
F. B. Guthrie and A. A. Ramsay.
THE POTATO MOTH ... ... ... ... W. W. Froggatt 321
FUMIGATING HEDGES FOR SCALE AND OTHER INSECTS ... ... 326
WHEATS AT THE BATHURST FARM, SEASON 1902 R. W. Peacock 327
CO-OPERATIVE AGRICULTURAL ASSOCIATIONS ... ... ... ... 329
CICADAS ("LOCUSTS") AND THEIR HABITS ... W. W. Froggatt 334
A DISEASE OF LARKSPUR ... ... ... ... N. A. Cobb 341
DAIRY NOTES ... ... ... ... ... M. A. O'Callaghan 342
Dairy Conference; Cream Grading; Duplicate Butter Entries at Agricultural Shows; Progeny of State Imported Stock as Prize-winners; Byron Bay Factory.
Variations in Rainfall ... ... ... ... C. T. Musson 345
Field Experiments with Potatoes ... ... Geo. L. Sutton 348

PAGE.
HAWKESBURY AGRICULTURAL COLLEGE—*continued.*
Quantity Measurements of Haystacks, Dams, &c. ... ... Cuthbert Potts. 355
A New Disease in Honey-comb ... H. W. Potts and A. Gale 359
Notes on Cow-pea ... ... ... ... ... C. T. Musson 362
Hawkesbury District Farm Notes... ... ... H. W. Potts 365

EMERALD RYE AT MILLTHORPE ... ... ... ... ... 367

FARM NOTES—
Bathurst District ... ... ... ... R. W. Peacock 368
Riverina District ... ... ... ... G. M. McKeown 369

ORCHARD NOTES ... ... ... ... ... ... W. J. Allen 371

PRACTICAL VEGETABLE AND FLOWER GROWING W. S. Campbell 375

A NEW TOMATO—HOLMES' SUPREME ... ... ... ... ... 379

GENERAL NOTES ... ... ... ... ... ... ... ... 381
Harvesting Broom Corn; Preparing Pork and Bacon for Home Use.

AGRICULTURAL SOCIETIES' SHOWS ... ... ... ... ... 384

## MAY.

SHEEP FEEDING AT JEMALONG—
Report on Mr. N. A. Gatenby's Experiment, A. A. Dunnicliffe 385

PASPALUM DILATATUM ... ... ... ... ... ... ... 399

ORANGE BORERS AT KURRAJONG ... ... ... ... ... 400

PRODUCING BEEF ON FARMS ... ... ... ... ... ... 401

CROPS AT WAGGA FARM ... ... ... G. M. McKeown 408

TRIAL OF OATS AT BATHURST FARM ... ... R. W. Peacock 412

SWINE-FEVER ... ... ... ... ... ... E. Stanley 413

SOME WOOD-BORING BEETLES AND THEIR HABITS W. W. Froggatt 414

CICADAS ("LOCUSTS") AND THEIR HABITS ... W. W. Froggatt 418

GOVERNMENT ASSISTANCE TO DAIRYING AND OTHER BRANCHES OF AGRICULTURE IN OTHER COUNTRIES ... M. A. O'Callaghan 426
Departmental Work in Ireland; Improvement of Live Stock; Subsidy to Agricultural Societies; Itinerant Instruction in Agriculture and Dairying; Supervision of Produce.

HAWKESBURY AGRICULTURAL COLLEGE—
Preparing Maize Ensilage at College Farm ... H. W. Potts 437
Shredded Maize Stalks ... ... ... ... H. W. Potts 442
Egg-laying Competition at H. A. College—Results of Twelve-months' Test ... ... ... Notes by D. S. Thompson 443
Arrowroot ... ... ... ... ... ... C. T. Musson 452
Hawkesbury District ... ... ... ... H. W. Potts 453

| | | PAGE. |
|---|---|---|
| FARM NOTES— | | |
| Riverina District ... ... ... ... | G. M. McKeown | 455 |
| ORCHARD NOTES ... ... ... ... ... ... | W. J. Allen | 456 |
| TREATMENT OF BEES FOR FOUL BROOD ... ... | A. Gale | 457 |
| PRACTICAL VEGETABLE AND FLOWER GROWING | W. S. Campbell | 458 |
| GENERAL NOTES ... ... ... ... ... ... ... .. | | 461 |
| Spraying for San José Scale on Apple-trees; Wheats at Parkville; Russian and Siberian Butter in England; on the value of Liquid Manure; SWINE-FEVER; Angora Goats; Phaseolus Beans; Rape for Pigs; Storing Potatoes; Preserving Eggs; Varieties of the Vine; Keeping Mosquitoes at Bay; Canadian Fruit Marks Act; Phylloxera-resistant Vine Stocks for distribution, season 1903; Conference of Pastoral and Agricultural Societies' Union; Chamber of Agriculture; Dairy Conference. | | |
| MARKET REVIEW... ... ... ... ... | H. V. Jackson | 478 |
| AGRICULTURAL SOCIETIES' SHOWS, 1903 ... ... ... ... | | 480 |

## JUNE.

| | | |
|---|---|---|
| INSECTS THAT DAMAGE WHEAT AND OTHER FOODSTUFFS ... ... | W. W. Froggatt. | 481 |
| FUMIGATING CITRUS TREES IN CALIFORNIA ... ... ... ... | | 492 |
| UNFAVOURABLE OPINION BY LORD KITCHENER AND HIS OFFICERS ON AUSTRALIAN HORSES... ... .. ... ... ... | | 493 |
| THE DAIRY CONFERENCE— | | |
| Discussion of the Dairy Industry Bill ... ... ... ... | | 505 |
| PASTORAL AND AGRICULTURAL SOCIETIES' UNION OF NEW SOUTH WALES, ANNUAL CONFERENCE ... ... ... ... ... | | 526 |
| PAPERS READ AT CONFERENCE— | | |
| Judging at Agricultural Shows ... ... ... | Mrs. Corrie | 533 |
| Open Judging ... ... ... ... | W. Muggridge | 534 |
| NEW SOUTH WALES CHAMBER OF AGRICULTURE—INAUGURAL MEETING ... ... ... ... ... ... ... ... | | 535 |
| REPORT ON MAIZE, POTATO, AND FRUIT CROPS ... ... ... | | 537 |
| IRRIGATION ... ... ... ... ... ... | W. J. Allen | 538 |
| UNIVERSAL NOMENCLATURE OF WHEAT ... ... | N. A. Cobb | 546 |
| DAIRY NOTES ... ... ... ... ... | M. A. O'Callaghan | 550 |
| Butter Exhibits at Royal Agricultural Show; Bacteriological investigation of competing Butters. | | |
| HAWKESBURY AGRICULTURAL COLLEGE— | | |
| Field Experiments with Maize—Season, 1902-3 | Geo. L. Sutton | 554 |
| Quantity Measurements ... ... ... | Cuthbert Potts | 565 |

FARM NOTES— PAGE.
Hawkesbury District ... ... ... ... H. W. Potts 571
Riverina District ... ... ... ... G. M. McKeown 574
Bathurst District ... ... ... ... R. W. Peacock 574
ORCHARD NOTES ... ... ... ... ... ... W. J. Allen 575
PRACTICAL VEGETABLE AND FLOWER GROWING W. S. Campbell 577
AGRICULTURAL SOCIETIES' SHOWS ... ... ... ... ... 578

## JULY.

SOME NATIVE AND EXOTIC GRASSES AT BATHURST FARM .. ... 579
R. W. Peacock.
SHEEP AT WOLLONGBAR FARM ... ... ... ...C. H. Gorman 584
VENTILATION IN DAIRIES ... ... ... ... C. Pedersen 588
WHITE ANTS ATTACKING FRUIT-TREES... ... ... ... ... 589
PASTORAL PURSUITS—FENCING ... ... ... W. G. Dowling 590
WHEAT AS A FOOD FOR PIGS ... ... ... ... ... ... 592
OUR FORESTRY PROBLEM... ... ... ... W. S. Campbell 593
THE YELLOW BOX AS A HONEY-PRODUCER ... ... ... ... 596
FUMIGATION .. ... ... ... ... ... W. J. Allen 597
USEFUL AUSTRALIAN PLANTS ... ... ... ... J. H. Maiden 607
No. 83.—*Eragrostis tenella.*
TEXAN TIMOTHY—A NEW AMERICAN GRASS FOR AUSTRALIA ... 608
J. H. Maiden.
CULTIVATION OF VINEYARDS ... ... ... ... ... ... 609
KILLING BLACKBERRY VINES ... ... ... ... ... ... 610
IRRIGATION ... ... ... ... ... ... R. T. McKay 611
LETTERS ON THE DISEASES OF PLANTS—2ND SERIES... N. A. Cobb 627
GRADING AND HARVESTING WHEAT FOR SEED ... ... ... 652
SOWING AND CULTIVATION OF LUCERNE IN ARID COUNTRY ... ... 652
FRUITS FOR HAY IRRIGATION AREA ... ... ... ... ... 653
FEEDING AND FIRM BACON ... ... ... ... ... ... 654
A LOCALLY-MANUFACTURED CATTLE FOOD ... ... ... ... 655
IRRIGATION FOR ONIONS... ... ... ... ... ... ... 655
HAWKESBURY AGRICULTURAL COLLEGE—
Field Experiments with Maize ... ... Geo. L. Sutton 656
A Handy Seed Drill ... ... ... Geo. L. Sutton 664
International Egg-laying Competition ... D. S. Thompson 667
Farm Notes for the Hawkesbury District... H. W. Potts 669

PAGE.
MULES ... ... ... ... ... ... ... ... ... 670
FARM NOTES—Riverina District ... ... G. M. McKeown 671
FRUIT-TREE BORING BEETLES ... ... ... ... ... ... 671
ORCHARD NOTES ... ... ... ... ... ... W. J. Allen 672
PRACTICAL VEGETABLE AND FLOWER GROWING .. W. S. Campbell 674
PRESERVING EGGS IN WATERGLASS SOLUTION ... ... ... ... 676
MARKET REVIEW ... ... ... ... ... H. V. Jackson 677
AGRICULTURAL SOCIETIES' SHOWS ... ... ... ... ... 680

## AUGUST.

LETTERS ON THE DISEASES OF PLANTS ... ... N. A. Cobb 681
Second Series—*continued.*
COLD STORAGE OF EGGS ... ... ... H. V. Jackson 713
STRAWBERRIES AND POTASH SALTS ... ... ... ... ... 715
NOTES ON AGRICULTURAL STATISTICS ... ... Walter Preedy 716
UTILISING HORSE MANURE ... ... ... ... ... ... 718
FISH FARMING ... ... ... .. ... ... Albert Gale 719
REPORT ON CROPS FROM EXPERIMENTAL PACKETS OF SEED ... ... 724
Haywood Bros.
A NATURE STUDY—THE WHITE ANT... ... W. W. Froggatt 726
DENTITION AND DEFINITION OF AGE OF SHEEP ... ... ... 731
E. D. E. Van Weenan.
FUMIGATION OF CITRUS TREES ... ... ... ... ... ... 733
MITCHELL GRASSES ... ... ... ... R. W. PEACOCK 734
HONEY IN ENGLAND ... ... ... ... ... Albert Gale 735
SWINE FEVER ... ... ... ... ... ...J. D. Stewart 737
THE PACKING OF BUTTER FOR EXPORT ... ... ... ... 751
CATTLE DOGS ... ... ... ... ... ... Robt. Kaleski 752
REPORT ON THE UNIVERSAL HYGIENIC MILK EXHIBITION, HAMBURG 759
C. C. Lance.
SOME SO-CALLED NATIVE FODDER PLANTS NOT ALWAYS EDIBLE ... 765
J. H. Maiden.

HAWKESBURY AGRICULTURAL COLLEGE—

Quantity Measurements—Areas of Irregular Blocks of Land ... 767
Cuthbert Potts.
Rations for Pigs ... ... ... ... ... Geo. Daley 771
ORCHARD NOTES ... ... ... ... ... ... W. J. Allen 773

PAGE.
MAIZE FODDER ... ... ... ... ... ... ... ... 774
FARM NOTES—RIVERINA DISTRICT ... ... G. M. McKeown 775
LEECHES .. ... ... ... ... ... ... ... ... 775
PRACTICAL VEGETABLE AND FLOWER GROWING W. S. Campbell 776
MARKET REVIEW... ... ... ... ... H. V. Jackson 780
AGRICULTURAL SOCIETIES' SHOWS ... ... ... ... ... 783

## SEPTEMBER.

ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE :—

Report of the Director of Agriculture ... ... ... ... 786
Report of the Pathologist ... ... ... ... ... ... 793
Report of the Chemist ... .. ... ... ... ... 794
Report of the Entomologist ... ... ... ... ... 797
Report of the Dairy Expert ... ... ... ... ... 804
Field Instructors ... ... ... ... ... ... 809
Report of the Fruit Expert ... ... ... ... ... 811
Wagga Orchard ... ... ... ... ... ... 813
Hawkesbury Agricultural College Orchard ... ... ... 832
Bathurst Orchard ... ... ... ... ... ... 839
Moree Orchard... ... ... ... ... ... ... 846
Pera Orchard ... ... ... ... ... ... ... 846
Wollongbar Orchard ... ... ... ... ... ... 847
Report of the Viticultural Expert... ... ... ... ... 848
Report of the Wheat Experimentalist ... ... ... ... 852
Report of the Government Botanist ... ... ... ... 857
Report on Agricultural, Pastoral, and Horticultural Societies' subsidies ... ... ... ... ... ... ... 859
Report on Cold Storage and Export Branch ... ... ... 865
Report of the Inspectors under Vegetation Diseases Act ... 870
Fumigating Chambers... ... ... ... ... ... 874
Report of the Principal, Hawkesbury Agricultural College ... 876
Report of the Manager, Experimental Farm, Wagga ... ... 900
Report of the Manager, Experimental Farm, Bathurst ... ... 916
Report of the Manager, Experimental Farm, Wollongbar ... 929
Report of the Manager, Experimental Farm, Coolabah ... ... 941
Report of the Manager, Moree Irrigation Farm ... ... ... 943
Report of the Manager, Experimental Farm, Belindigarbar Farm, Grafton... ... ... ... ... ... ... 945
Report of the Manager, Experimental Farm, Glen Innes ... 951
Agricultural Societies' Shows ... ... ... ... ... 954

## OCTOBER.

PAGE.

LETTERS ON THE DISEASES OF PLANTS ... ... N. A. Cobb 955
Second Series (*continued*)—
Canker; Peach-curl; Alternaria of Citrus Tribe; Melanose (?); Black Spot; Decay in Market Lemons; Diseases of the Passion-vine—Woodiness, Macrosporium, Faulty Leaves, Ripe-rot; Diseases of the Walnut; Leaf-curl of the Potato; Disease of Chillies; Disease of Onions; Root-rots and Timber Rots; Disease in Seed Potatoes.

USEFUL AUSTRALIAN PLANTS ... ... ... ... J. H. Maiden 987
No. 84—*Eragrostis nigra.*

GEORGE CALEY—Botanical Collector, 1800–10 ... ... ... 988

DAMS IN GULLIES FOR TEMPORARY WATER SUPPLY AND SILTING-UP PURPOSES ... ... ... ... ... ...R. H. Gennys 997

CHEESE IN SOUTH AFRICA ... ... ... ... Geo. Valder 998

SALTBUSH ... ... ... ... ... ... P. J. Holdsworth 1001

STOCK AND STRINGYBARK TREES ... ... ... J. H. M. 1002

WATER FOR DAIRY PURPOSES ... ... ... M. A. O'Callaghan 1003

INSECTARIUM NOTES, AND INSECTS FOUND ABOUT THE HAWKESBURY AGRICULTURAL COLLEGE ... ... ... W. W. Froggatt 1019
Hawk-moth; Ribbed Case-moth; Cotton-ball Moth; Painted Acacia Moth; Forest Bag-web Moth; Soy Bean Moth; Underground Maize Beetle; Orange Butterfly Parasite; Leaf-mining Fly; Snow Fly; Common Black Thrips.

ANGORA GOATS IN AUSTRALIA ... ... ... R. N. Blaxland 1028

A NEW MAIZE—GOLDEN BEAUTY—FOR TRIAL... A. A. Dunnicliffe 1036

HAWKESBURY AGRICULTURAL COLLEGE—
Seed Maize—Its Selection and Improvement. Geo. L. Sutton 1037
The Evolution of a Potato ... ... ... ... C. T. Musson 1043
Paspalum Seed Again ... ... .. ... C. T. Musson 1045
Meteorological Note... ... ... ... ... ... ... 1047
Egg-laying Competition—Third Competition (International) ... 1048
D. S. Thompson.
Farm Notes ... ... ... ... ... ... H. W. Potts 1049

PRACTICAL VEGETABLE AND FLOWER GROWING... W. S. Campbell 1052

AGRICULTURAL SOCIETIES' SHOWS ... ... ... ... ... 1055

## NOVEMBER.

PAGE

LETTERS ON THE DISEASES OF PLANTS ... ... N. A. Cobb 1057
Second Series (*continued*)—
Bean Rust; Cabbages attacked by Peronospora; Black Spot or Fusicladium of the Loquat; Diseases of the Flower Garden—Cosmia; Hollyhocks; Rose; Larkspur; Chrysanthemum; Carnation—Hawthorn Hedge; Preparation of Bordeaux Mixture; Adulteration of Sulphur; Fungi from Cuttings.

MACARONI WHEATS ... ... ... ... ... W. Farrer 1073

PIGS FOR THE DESTRUCTION OF CODLIN MOTH GRUBS ... ... 1077

THE CHEMICAL NATURE OF THE SOILS OF NEW SOUTH WALES, WITH SPECIAL REFERENCE TO IRRIGATION ... F. B. Guthrie 1078

PASPALUM DILATATUM GRASS AT COOTAMUNDRA W. H. Matthews 1087

THE MURRAY WATERS AND IRRIGATION ... R. T. McKay 1088
Modification of the Premiers' Agreement *re* use of Murray Waters; Irrigation in Egypt, United States, Countries bordering the Mediterranean—France, Italy; and India.

LATE GRAPES FOR EXPORT ... ... ... ... J. H. Ellis 1101

LOCUSTS AND GRASSHOPPERS ... ... ... W. W. Froggatt 1102

CALF-REARING EXPERIMENTS BY THE IRISH DEPARTMENT OF AGRICULTURE... ... ... ... ... M. A. O'Callaghan 1111

DAIRY NOTES ... ... ... ... ... M. A. O'Callaghan 1114
The Dairy Bill; Dairy Short-horn Herd Book.

EXPORTATION OF POULTRY TO VICTORIA ... ... ... ... 1117

SCALDING PIG CARCASES... ... ... ... C. T. Edwards 1117

HAWKESBURY AGRICULTURAL COLLEGE—
Experiments with Cowpeas ... ... ... Geo. L. Sutton 1118
Concerted Action in the Poisoning of Sparrows ... ... ... 1124
Hawkesbury District Farm Notes ... ... ... H. W. Potts 1125

FARM NOTES—Riverina District ... ... G. M. McKeown 1128

ORCHARD NOTES ... ... ... ... ... ... W. J. Allen

THE NUT GRASS COCCID ... ... ... ... ... ... 1130

PRACTICAL VEGETABLE AND FLOWER GROWING W. S. Campbell 1131

CINQUATINA MAIZE ... ... ... ... ... ... ... 1135

MARKET REVIEW ... ... ... ... ... H. V. Jackson 1137

AGRICULTURAL SOCIETIES SHOWS ... ... ... ... ... 1141

# DECEMBER.

PAGE.
Irrigation ... ... ... ... ... ... W. J. Allen 1143
Wheat Returns ... ... ... ... ... ... ... 1148
Co-operative Grain Stores (in Europe) ... ... ... 1149
Linseed for Young Calves ... ... ... ... ... 1153
Permanent Provision against Drought ... W. H. Clarke 1154
Cattle Ringbarking Trees ... ... ... ... ... 1156

Lessons of the Drought—

Grafton District ... ... ... ... ... C. W. Sabine 1157
Macleay River District ... ... ... ... H. C. Palmer 1158
South Coast District ... ... ... ... P. Quirk 1159
New England District ... ... ... ... R. H. Gennys 1161
Moree District ... ... ... ... *Moree Examiner* 1163
Warialda District... ... ... ... R. Kirkpatrick 1165
Merriwa District ... ... ... ... ... W. H. Lowe 1166
Murrurundi District ... ... ... ... C. Brooks 1166
Mudgee District ... ... ... ... ... C. J. Crocker 1167
Forbes District ... ... ... ... W. G. Dowling 1168
Cooma District ... ... ... ... ... C. K. Hudson 1169
Bombala District ... ... ... ... R. W. Dawson 1169
Gundagai District ... ... ... P. W. C. Palmer 1169
Riverina District ... ... ... ... G. M. McKeown 1171
Wagga Land District ... ... ... T. P. Mulligan 1175
Deniliquin District ... ... ... ... J. Weir 1176
Making Bush Hay ... ... ... ... ... R. W. Peacock 1177
Drought Statistics ... ... ... ... ... W. Preedy 1178
Notice to Farmers, Pastoralists and Land Occupiers Generally ... ... ... ... ... J. H. Maiden 1181
Cold Storage of Fruit ... ... ... Geo. Bradshaw 1182
Good Implements and Profit ... ... ... ... ... 1198
Detection of Formalin in Butter ... M. A. O'Callaghan 1201
English Grasses for a Cool Climate ... A. A. Dunnicliff 1202

Hawkesbury Agricultural College—

The Climbing Cut-worm in the Hawkesbury District— H. W. Potts. 1203
A Supposed Remedy for Fruit-tree Pests ... C. T. Musson 1206
Experiments with Rape and Swedes, I ... Geo. L. Sutton 1208
Sheep Poisoning at the College Farm ... ... H. W. Potts 1212
Observations on the late Drought at the College Farm H. W. Potts 1215
Farm Notes ... ... ... ... ... H. W. Potts 1219

PAGE.
ON THE GROWING OF BARLEY FOR MALTING ... M. Wagner 1222
REPORT ON THE TRADE IN CITRUS FRUIT IN SICILY ... ... 1224
FARM NOTES—
Riverina District ... ... ... ... G. M. McKeown 1227
ORCHARD NOTES ... ... ... ... ... W. J. Allen 1228
FRAUDS IN SEED SELLING ... ... ... ... J. H. Maiden 1229
GENERAL NOTES— 1231
Pineapple Wine; Destroying House Bugs; Export of Mutton to London; The Lucerne Tree; Cultivation of Melons; Productiveness of Crossbred Wheats; Cattle and Horses Ringbarking Trees; FIREBREAKS.
AGRICULTURAL SOCIETIES' SHOWS ... ... ... ... ... 1236

# INDEX.

PAGE.

- Adams, H.—Annual Report ... ... 874
- Age of—
  - Seed, Experiment ... ... ... ... ... 196
  - Sheep, Definition of ... ... ... 731
- Agricultural Associations, Co-operative .. 329
- Agricultural Societies' Shows 96, 192, 288, 384, 480, 578, 680, 783, 954, 1055, 1141, 1236
  - Subsidies—Annual Report ... ... 859
  - In Ireland ... ... ... ... ... 431
- Aim of grading Wheat ... ... ... 43
- Aleuron Layer of Wheat ... ... ... 546
- Alford, J.—
  - Annual Report ... ... ... ... 889
  - Lemon-trees losing their Leaves... ... 272
- Allen, W. J.—
  - Annual Report ... ... ... ... 811
  - Bottling Apples ... ... ... ... 126
  - Fruits for Hay Irrigation Area... ... 653
  - Fumigation ... ... ... ... ... 597
  - Irrigation ... ... ... ... ... 538
    - in California ... ... ... ... 1143
    - at Pera Bore ... ... ... ... 1145
  - Manure Experiments with Passion Vines 252
  - Spraying Apple-trees for San José Scale 461
- Almeria Grape for Export ... ... ... 1101
- Almonds at—
  - Bathurst Orchard ... ... ... ... 844
  - Wagga Orchard ... ... ... ... 820
- Ambrosia Beetle ... ... ... ... 415
- American Blight ... ... ... ... 18
- Ammonium Sulphocyanide, Effects of, on Crops ... ... ... ... ... 117
- Analyses of Commercial Fertilisers in New South Wales. 1903 List ... ... 313
- Analysis of—
  - A Locally-manufactured Cattle Food ... 655
  - Field Peas and Tares or Vetches as Green Manure in Orchards ... ... 180
  - Guinea Grass ... ... ... ... 935
  - Lucerne-tree ... ... ... ... 1233
- Anconas as Egg-producers ... ... ... 121
- Angora Goats ... ... ... ... ... 465
  - in Australia... ... ... ... ... 1028
- Annual Report—
  - of Department of Agriculture, 1902 ... 785
  - Agricultural Societies' Subsidies ... 859
  - Bathurst Farm ... ... ... ... 916
  - Bathurst Orchard ... ... ... ... 839
  - Belindigarbar Farm ... ... ... 945

PAGE.

- Annual Report—*continued.*
  - Berry Stud Farm ... ... ... ... 804
  - Chemist .. ... ... ... ... 794
  - Cold Storage and Export Branch ... 865
  - Coolabah Farm ... ... ... ... 941
  - Dairy Expert ... ... ... ... 804
  - Entomologist ... ... ... ... 797
  - Wagga Experimental Farm ... ... 900
  - Field Instructors in Dairying ... ... 809
  - Fruit Expert ... ... ... ... 811
  - Glen Innes Farm ... ... ... ... 951
  - Government Botanist ... ... ... 857
  - Grafton Farm ... ... ... ... 945
  - Hawkesbury Agricultural College ... 876
    - Blacksmith ... ... ... ... 895
    - Dairy Instructor ... ... ... 888
    - Engineer ... ... ... ... ... 899
    - English Master ... ... ... ... 874
    - Experimentalist... ... ... ... 884
    - Farm Foreman ... ... ... ... 895
    - Lecturer in Chemistry and Physics ... 878
    - Orchard Manager ... ... ... 889
    - Pig Stud Manager ... ... ... 892
    - Poultry Expert ... ... ... ... 892
    - Works Overseer... ... ... ... 890
    - Prize Lists, 1902... ... ... ... 896
  - Moree Irrigation Farm ... ... ... 943
  - Moree Orchard ... ... ... ... 846
  - Pera Orchard ... ... ... ... 846
  - Inspectors under Vegetation Diseases Act 870
  - Viticultural Expert ... ... ... 848
  - Wheat Experimentalist ... ... ... 852
  - Wollongbar Farm ... ... ... ... 929
    - Orchard ... ... ... ... ... 847
- Anthracoid in Sheep... ... ... ... 16
- Apples—
  - at Bathurst Orchard ... ... ... 840
  - at Hawkesbury Agricultural College Orchard ... ... ... ... ... 833
  - at Wagga Orchard... ... ... ... 815
  - Bottling ... ... ... ... ... 126
  - for Cider, a new Machine for Crushing... 275
- Apple—
  - Mouldy Core of the ... ... ... 705
  - Reinette Jaune Hâtive, Stone Pippin ... 576
  - Sections of Reinette Jaune Hâtive, Stone Pippin ... ... ... ... ... 672
- Apple-trees—Spraying for San José Scale 461
- Apricot Pulp ... ... ... ... ... 14

PAGE.
Apricots at—
  Bathurst Orchard ... ... ... ... 843
  Hawkesbury Agricultural College Orchard 833
  Wagga Orchard ... .. ... ... 819
Arid Regions—
  Means to ameliorate the Conditions of .. 97
  Grazing Lands ... ... ... ... 99
Army Horses, Prices paid for ... ... 504
Arrowroot ... ... ... .. ... 452
  at Wollongbar Farm ... .. . . 930
Arsenious Acid, Effect of, on Crops ... 119
Artesian Water for Irrigation at Goodooga 110
Artichokes—
  (Jerusalem) at Bathurst Farm ... ... 923
  at Wagga Farm ... ... ... ... 912
  at Wollongbar Farm ... ... ... 930
Asparagus at Bathurst Farm ... ... 927
Ausburn, C. H.—Annual Report ... ... 895

Barleys—
  at Bathurst Farm ... ... ... ... 917
  Coolabah Farm ... ... ... ... 942
  Moree Farm ... ... ... ... 944
  Wagga Farm ... ... ... ... 903
  at Wollongbar Farm ... ... ... 930
  For malting, on the growing of ... ... 1222
Barley Grass—
  in Deniliquin District ... ... ... 1177
  in Gundagai District ... ... .. 1171
Bacon—Feeding and Firm .. ... ... 654
Bacon and Pork for Home use, preparing... 382
Bacteriological condition of Butters at Royal Agricultural Society's Show, 1903 550, 553
Bacterial Nodules on Cowpea Roots ... 363
Banana Scab ... ... ... ... ... 681
Banks in connection with Agricultural Associations ... ... ... ... 332
Bathurst Farm—
  Annual Report ... ... ... ... 916
  Orchard Annual Report ... ... ... 839
  Trial of Oats ... ... ... ... 412
  Wheats—Season 1902 ... ... ... 327
Beans, Phaseolus ... ... ... ... 467
Bean—
  Rust ... ... ... ... ... ... 1057
  Weevil, Buff-coloured ... ... ... 488
Beans at Wollongbar Farm... ... ... 930
Beef on Farms, Producing ... ... ... 401
Beef Production and Dairying ... ... 405
Bees—Appliances—
  Wire Section Cradles ... ... ... 247
  A new Disease in Comb ... ... ... 359
  Care of New Swarms ... ... ... 247
  Honey in England... ... ... ... 735
  The Yellow Box as a Honey-producer ... 596
  Treatment of, for foul-brood ... ... 457
Bee Matters ... ... ... ... ... 247
Beetles—
  Ambrosia Beetle ... ... ... ... 415
  Fruit-tree Boring ... ... ... ... 671
  Furniture Beetle ... ... ... ... 416
  The Confused Flour ... ... ... 485
  The Grain ... ... ... ... ... 487
  The Meal-worm ... ... .. ... 486
  Powder-keg Longicorn ... ... ... 417

PAGE.
Beetles—*continued.*
  Saw-toothed Grain ... ... ... 487
  The Slender-horned Flour ... ... 486
  The Underground Maize .. ... 1022, 1024
  Wine-cask .. ... ... ... ... 414
  Wood-boring, and their habits ... ... 414
Belindigarbar Experimental Farm Annual Report . ... ... ... ... 945
Berry Stud Farm—Annual Report... ... 804
Blackberry, The—Exterminating with Pigs 986
Blaxland, R. A.—Angora Goats in Australia 1028
Black Mexican .. ... ... ... 663
Black Spot—
  of the Citrus Fruits ... ... ... 968
  of the Loquat ... ... ... ... 1058
  of the Rose ... ... ... ... ... 1063
Bluestone for Bunt ... ... ... 207, 213
Blunno, M.
  Annual Report ... ... ... ... 848
  Control of Temperature of Wine Fermentation ... ... ... ... ... 135
  Making unfermented Wine ... .. 256
  Stability of colouring matter in Red Wines ... ... ... ... 55, 131
Bordeaux Mixture, Preparation of... ... 1070
Borers, Orange, at Kurrajong ... .. 400
Boring Beetles at Kurrajong ... ... 671
Bottling Apples ... ... ... ... 126
Bradshaw, Geo.—
  About Eggs... ... ... ... ... 127
  Cold Storage of Fruit ... ... ... 1182
  New Breeds and Varieties of Fowls ... 127
Brooks, A.—
  Annual Report ... ... ... ... 890
  Construction of Pig-sty Buildings ... 65
Brooks, C.—Lessons of the Drought, Murrurundi District... ... ... ... 1166
Broom Corn, Harvesting ... ... ... 381
Browne, G. W.—The Blackberry ... ... 986
Bruce, Alex.—Unfavourable opinion by Lord Kitchener and his officers on Australian Horses ... ... ... 403
Buck-wheat at Bathurst Farm ... ... 923
Buildings at Wollongbar Farm ... ... 930
Bugs, Destroying House ... ... ... 1232
Bull killed by a Needle ... ... ... 1018
Bulkeley, Jos. A.—Annual Report ... 945
Bush, Native—Fodder Plants and the preferences of Stock ... ... ... 17
Bunt, Experiments of, 1901 (*Farrer*) ... 206
  Bluestone ... ... ... ... 207, 213
  Corrosive Sublimate ... ... 209, 214
  Copper Sulphate ... ... ... ... 207
  Formalin .. ... ... ... 208, 214
  Results of with different Fungicides ... 210
Bunt in Wheat, effect of Steam ... ... 28
Bush-hay, making ... ... ... ... 1177
  at Coolabah Farm ... ... ... ... 942
Butler, E. D.—Annual Report ... ... 872
Butter—
  at London Dairy Show ... ... ... 90
  Cheese *versus* ... ... ... ... 233
  Detection of Formalin in... ... ... 1201
  Entries at Agricultural Shows, Duplicate 343
  Exhibits at the Royal Agricultural Show, 1903 ... ... ... ... ... 550

Butter—*continued.* PAGE.
- for Export, Packing 751
- Flavours 231
- Mottled 231
- Pasteurisation 763
- Examples of good and bad Packing 229–230
- Faults in Manufacture 229
- Russian and Siberian in London 461
- Storing and prices 64

Butter Show—Fifth State 227

Cabbage—
- Trial of "Phenomenal" at Howlong 113
- Cabbages attacked by Peronospora 1057
- at Wagga Farm 913

Caley, Geo.—Botanical Collector 988

Calves—
- Beef on Farms 401
- Linseed for Young 1153
- White Scour or Lung Disease 1

Calf-rearing Experiments in Ireland 1111

Calf Stall-feeders 239

Campbell, W. S.—
- Annual Report, 1902 785
- A new Tomato 379
- Our Forestry Problem 593
- Practical Vegetable and Flower Growing—Monthly Notes. (*See* under V.)

Canadian Fruit Marks Act 475

Canker 955

Carnation, Rust of 1067

Carrots, Field at Bathurst Farm 926

Cattle—
- at Bathurst Farm 928
- Grafton District 1158
- in South Coast District 1160
- at Wagga Farm 904
- at Wollongbar Farm 937

Cattle Dogs 752

Cattle Food, a locally manufactured 655

Cattle and Horses Ringbarking Trees 1156, 1235

Chaff as a Drought Fodder, Warialda District 1165

Chaff, Cocky, at Wagga Farm 913

Chaffing Fodder for Dairy Cattle 1159

Chamber of Agriculture—
- Establishment of 477
- Inaugural Meeting 535

Cheese *v.* Butter 233

Cheese in South Africa 998

Chemical Nature of the Soils of New South Wales, with special reference to Irrigation 1078

Cherries at—
- Bathurst Orchard 844
- Wagga Orchard 820

Cherry, W. H. P.—Agricultural Societies' Subsidies 859

Chillies, Diseases of 980

Chinese Raisins at Hawkesbury Agricultural College Orchard 839

Chomley, F. G.—Annual Report 875

Chrysanthemum Leaf Disease 1066

Cicadas (Locusts) and their Habits 334, 418

Cider—A new Machine for Crushing Apples for 275

PAGE.

Cinquatina Maize 664, 1135

Citrus Fruits at Hawkesbury Agricultural College Orchard 833
- Trade in Sicily 1224

Citrus Tribe, Alternaria of the 962

Clarke, W. H.—Permanent Provision against Drought 1154

Cobb, N. A.—
- Annual Report, 1902 793
- Adulteration of Sulphur 1071
- A Handy Horse-power 170
- Alternaria of the Citrus Tribe 962
- A Ripe-rot Fungus of the Passion Vine 976
- Bean Rust 1057
- Black Spot—
  - of the Citrus Fruits 968
  - or Fusicladium of the Loquat 1058
  - of the Rose 1063
- Cabbages attacked by Peronospora 1057
- Canker 955
- Chillies, Diseases of 980
- Cosmia, Disease of 1038
- Diseases of Plants—
  - Letters on, 627, 681, 955.
- Diseases of the—
  - Flower Garden 1059
  - Hawthorn Hedge 1068
  - Larkspur 341, 1065
  - Passion Vine 970
  - Walnut 977
- Effect of Engine-boiler Steam on Vitality of Seeds and Spores 26
- Faulty Leaves on the Passion Vines 973
- Ripe Rot Fungi growing naturally on various kinds of Vegetation 638
- Fungi Grow from Cuttings 1072
- Grading and Harvesting Wheat for Seed 652
- Hollyhocks, Disease of 1061
- Ripe Rot Inoculation Experiments 633
- Leaf Curl of the Potato 978
- Leaf Disease of the Chrysanthemum 1066
- Lemons decaying while on the Market 969
- Letters on the Diseases of Plants 627, 681, 955
- Macrosporium of Citrus Tribe 962
- Melanose 966
- Onion Disease 980
- Peach Curl 955
- Pleospora of the Passion Vine 972
- Preparation of Bordeaux Mixture 1070
- Ripe Rot 628
  - Remedies for 646
- Ripe Rots and their names 641
- Root Rots and Timber Rots 981
- Rust of the Carnation 1067
- Seed Potatoes, Disease in 985
- Seed Wheat 33, 145, 193
- Stigmonose 692
- Universal Nomenclature of Wheat 546

Cobb, Geo.—Annual Report 895

Codlin Moth Grubs, Pigs for the destruction of 1077

Coffee-growing on the Clarence 283
- at Wollongbar Farm 931

Corrie, Mrs. Sophie—Judging at Agricultural Shows 533

PAGE.

- Cold Storage and Export—Annual Report ... 865
  - of Eggs ... 713
  - of Fruit ... 1182
- Collar Rot of Lemon-trees ... 272
- Coloured Plate—
  - Diseases of Plants ... 646, 681
  - Elberta Peach ... 374
  - Keiffer's Hybrid Pear ... 374
  - Formalin in Butter ... 1201
  - Locusts and Grasshoppers ... 1102
  - Potato Moth ... 321
  - Reinette Jaune Hâtive Apple ... 576
  - Sections of a Grain of Wheat ... 548
  - Stone Pippin Apple ... 576
- Compressed Vegetable Moth ... 490
- Condensed Milk ... 30, 221
  - Composition ... 225
  - *versus* Concentrated Milk ... 222
  - Technique of Manufacture ... 226
- Conference *re* Dairy Bill ... 342
  - Pastoral and Agricultural Societies' Union ... 477, 526
- Conservation of Fodder at Wagga Farm ... 1171
- Conserving Native Grasses at Coolabah Farm ... 942
  - Seed Wheat for future use ... 197
- Conservation of Water ... 997
  - Near belts of Scrub ... 1166
- Coolabah Farm—Annual Report ... 941
- Co-operative Agricultural Association ... 329
- Co-operation amongst Dutch Market Gardeners ... 310
- Co-operative Grain Stores ... 1149
- Copper Sulphate for Bunt ... 207
- Corowa Conference ... 291
- Corrosive Sublimate for Bunt ... 209, 214
- Cosmia, Disease of ... 1059
- Cost and Utility of Graded Seed ... 197
- Cotton at—
  - Bathurst Farm ... 923
  - Wollongbar Farm ... 931
- Cotton-boll Moth ... 1021
- Cowpea, Bacterial Nodules ... 363
- Cowpeas at Bathurst Farm ... 920
  - Coolabah Farm ... 942
  - Comparative Trial of eight varieties ... 1118
- Cowpea-vine Hay Curing and Stacking ... 91
  - for Dairy Farmers ... 96
  - Effect of Fertilisers upon yield of greenstuff ... 1120
  - Fertiliser Experiments ... 1121
  - Notes on ... 362
  - for Pigs at Hawkesbury Agricultural College ... 1219
  - at Wagga ... 906
  - at Wollongbar Farm ... 931
  - Root Galls on ... 362
- Cream at Byron Bay Factory, Grading ... 344
  - Grading ... 236, 342
- Crocker, C. J.—Lessons of the Drought in Mudgee District ... 1167
- Crops which resisted drought, Grafton District ... 1157
- Curing Cowpea-vine Hay ... 91
- Cultivation of Vineyards ... 609
- Curing Sorghum Hay ... 175

PAGE.

- Cultivation and Manures in dry seasons at Wagga Farm ... 1175
- Cultivation in dry seasons at Hawkesbury Agricultural College ... 1216
- Cut-worms in Hawkesbury District ... 1203

- Dairy Bill ... 1114
  - Conference *re* ... 505
- Dairy Cattle—
  - Demand for Bulls ... 64
  - Durhams, Guernseys, and Holsteins ... 235
  - Guernsey, "Peter," at Wollongbar ... 236
  - Guernsey, "Prince Moscow," at Picton 238
  - Guernsey Bull, by "Rose Prince," for Wollongbar district ... 238
  - Heifers, by Durham "Favourite" ... 235
  - Holstein, "President," at Tweed ... 238
  - Jersey Heifer, by "Thessalian" ... 344
  - Jersey, "Melbourne," at Singleton ... 236
  - Kerry, "Aicme Chin," at Stroud ... 236
  - Kerry, "Kildare," on the Tweed River 235
  - Kerry Records at Berry ... 235
  - Milk records of Imported Cows at Wollongbar Farm ... 238
  - Monthly Milking Record Register ... 939
  - Prize-winner by "Cornish Boy" ... 235
  - Shorthorn Cow—First Prize, Royal Show, Carlisle ... 236
  - Shorthorn Cow—
    - "Red Queen," winner Barham Challenge Cup, London Dairy Show ... 237
    - "Trefoil"—Spencer Challenge Cup ... 237
  - Tring Park Records ... 238
  - White Scour, or Lung Disease ... 1
- Dairy Notes ... 342, 550
- Dairy—
  - Calf Stall-feeders ... 239
  - Cheese *v.* Butter ... 233
  - Condensed Milk ... 30
  - Cream-grading ... 342
  - Dairy Conference—Report of Proceedings ... 342, 505
  - Dairy Farmers—Cowpea for ... 96
  - Fifth State Butter Show ... 227
  - Grading Cream at Byron Bay Factory ... 344
  - Implements and Utensils at Hamburg Exhibition ... 759
  - Movements of Inspectors ... 63
  - Shorthorn Herdbook ... 1116
  - Show, London ... 90
  - Produce in Ireland, Inspection and Transit 436
  - Dairies, Ventilation in ... 588
  - Dairying, Beef-production and ... 405
  - Dairying in Ireland—
    - Bulls for use of Farmers ... 426
    - Premiums for Bulls ... 427
    - Itinerant Instruction in, in Ireland ... 434
    - Lease of Bulls to Farmers ... 427
  - Dairies—Inspection of, in Europe ... 759
  - Dairy Instructor at Hawkesbury Agricultural College—Annual Report ... 888
  - Lawrence-Kennedy Milking Machine ... 63
  - Pure Drinking-water for Cattle ... 31
  - Dairy Purposes, Water for ... 1003

PAGE.

Daley, Geo.—
  Annual Report ... ... ... ... ... 892
  Rations for Pigs ... ... ... ... ... 771
Dams in Gullies for Temporary Water Supply ... ... ... ... ... 997
  Measuring ... ... ... ... ... ... 355
Dawson, R. W.—Lessons of the Drought, Bombala District ... ... ... 1169
Dentition and Definition of Age of Sheep... 731
Devon Cattle ... ... ... ... ... ... 251
Director of Agriculture—Annual Report, 1902 ... ... ... ... ... ... 785
Disease—Collar Rot of Lemon-trees ... 272
Diseases of the Flower Garden—
  Cosmia ... ... ... ... ... ... 1059
  Larkspur ... ... ... ... ... ... 341
  Mouldy Core of the Apple ... ... 705
  Letters on ... ... ... ... ... ... 627
  Stigmonose ... ... ... ... ... ... 692
  Scab in Bananas ... ... ... ... ... 681
  Quince Rots ... ... ... ... ... 709
  Ripe Rot ... ... ... ... ... ... 628
  Shot-hole Stigmonose ... ... ... 696
Disease in Honeycomb, A New ... ... 359
  in Sheep ... ... ... ... ... ... 15
Dowling, W. G.—
  Anthracoid in sheep ... ... ... 16
  Diseases in Sheep—Stranguary ... .. 15
  Fencing ... ... ... ... ... ... 590
  Lessons of the Drought in Forbes District 1168
  Pastoral Pursuits ... ... ... ... 590
Drill, a Handy Seed- ... ... ... 664
Drought—
  Lessons of the ... ... ... 1157, 1177
  Fodder Crops for ... ... ... ... 111
  Means to ameliorate in U.S A. ... ... 97
  Sorghum-growing in time of ... ... 111
  Statistics ... ... ... ... ... ... 1178
Dunnicliff, A. A.—
  A New Maize ... ... ... ... 1036
  English Grasses for a Cool Climate ... 1202
  Report on N. A. Gatenby's Irrigation Experiment at Jemalong ... ... 385

Early Clarence River ... ... ... 657
Edible Trees and Scrubs in—
  Merriwa District ... ... ... ... 1166
  Mudgee District ... ... ... ... 1167
  Murrurundi District ... ... ... 1167
  New England ... ... ... ... 1162
  Wagga Land District ... ... ... 1176
  Warialda District ... ... ... ... 1165
Egg Averages at Hawkesbury Agricultural College Competitions ... ... ... 1048
Eggs—
  Cold Storage of ... ... ... 282, 713
  Composition ... ... ... ... ... 128
  Formation ... ... ... ... ... ... 131
  Ovary and Oviduct of laying hen ... 121
  Production ... ... ... ... ... ... 132
  Preserving in Water-glass solution ... 676
  Various methods of Preserving ... ... 472
  Interesting Paragraphs ... ... ... 279

PAGE.

Egg-producers, Anconas as ... ... ... 121
Egg-laying Competition, Third (International) ... ... ... ... 667, 1048
  at Hawkesbury Agricultural College ... 443
  Results of Twelve Months Test ... ... 445
Elephant Beetle-borer at Kurrajong ... 400
Ellis, T. F.—Late Grapes for Export ... 1101
Emerald Rye at Millthorpe... ... ... 367
Emmer at Wagga Farm ... ... ... 906
Ensilage—
  at Bathurst Farm .. ... ... ... 924
  Chaff-cutter preparing Maize Stacks, Hawkesbury Agricultural College ... 440
  Filling Silos at Hawkesbury Agricultural College ... ... ... ... 440
  Gundagai District ... ... ... ... 1170
  Hawkesbury Agricultural College ... 1217
  Harvesting Maize for, with Reaper and Binder ... ... ... ... ... ... 438
  Loss in Storage and Handling ... ... 441
  Maize ... ... ... ... ... ... 171
  from Native Grasses, at Wagga Wagga Farm ... ... ... ... ... ... 1172
  Preparing Maize at Hawkesbury Agricultural College ... ... ... ... 437
  in South Coast District ... ... ... 1159
Evaporation—Use of Plants for Checking Water ... ... ... ... .. 257
Excavations, Measuring ... ... ... 355
Exhibits at Royal Agricultural Show, 1903, Butter ... ... ... ... ... 550
Exhibition, Report on the Universal Hygienic Milk, Hamburg ... ... 759
Experiments—
  with Cowpeas ... ... ... ... 1118
  for Farmers... ... ... ... ... 259
  Field, with Maize, Hawkesbury Agricultural College ... ... 554, 656
  with Oats and Wheat at Pambula ... 724
  with Potatoes at Hawkesbury Agricultural College ... ... ... ... 348
  with Rape ... ... ... ... 1208
Export—
  and Cold Storage—Annual Report ... 865
  Late Grapes for ... ... ... ... 1101
  of Mutton to London ... ... ... 1232
  Packing Butter for ... ... ... 751
  of Prize Mutton ... ... ... ... 242
Exportation of Poultry to Victoria ... 1117
Extra Early Golden Flint Maize ... ... 657
Farm Notes—
  Bathurst—
    January .. ... ... ... ... ... 84
    February ... ... ... ... ... 177
    March ... ... ... ... ... ... 269
    April ... ... ... ... ... ... 368
    June ... ... ... ... ... ... 574
  Hawkesbury—
    January ... ... ... ... ... 81
    February ... ... ... ... ... 173
    March ... ... ... ... ... ... 264
    April ... ... ... ... ... ... 365
    May ... ... ... ... ... ... 453
    June ... ... ... ... ... ... 571
    July ... ... ... ... ... ... 669

PAGE.

Farm Notes—*continued.*
- Hawkesbury—
  - October ... 1049
  - November ... 1125
  - December... ... 1219
- Riverina—
  - January ... 85
  - February... ... 178
  - March ... 270
  - April ... 369
  - May ... 455
  - June ... 574
  - July ... 671
  - August ... 775
  - November ... 1128
  - December... ... 1227

Farrer, W.—Annual Report ... 852
- Bunt, Experiments of, 1901 ... 206
- Destruction of Sparrows ... 286
- Macaroni Wheats ... 1073

Feeding Experiments, Calf, in Ireland ... 1111

Feeding and Firm Bacon ... 654

Feeding Starving Stock at Moree Farm ... 944

Fencing ... 590

Fermentation—Control of Temperature of Wine ... 135

Fertilisers—Analyses, 1903 List ... 313

Fibre Plants at Wollongbar Farm... ... 932

Field Peas—Analysis of ... 181

Figs at Bathurst Orchard ... 844
- Hawkesbury Agricultural College Orchard ... 838

Firebreaks ... 1236

Fish Farming... ... 719

Flax at Bathurst Farm ... 923

Fleas ... 93

Flour Beetle—The Confused ... 485

Flour Beetle—The Slender-horned ... 486
- Moth, Mediterranean ... 489

Fly—
- Leaf-mining and Parasites ... 1024, 1025
- The Snow ... 1026

Fodder—
- A Locally Manufactured ... 655
- Treatment of Withered Maize ... 169
- Plants at Bathurst Farm... ... 928
- Green Winter, at Bathurst Farm ... 924
- Green, for Farm Horses ... 87
- used at Wagga Farm ... 913
- Rape for Pigs ... 468

Fodder Plants—
- Some so-called Native, not always Edible 765
- and the Preferences of Stock ... 17

Foodstuffs and Wheat—Insects that damage stored ... 481

Forest Bog Moth ... 1022

Forestry Problem, our ... 593

Formalin—
- Detection of, in Butter ... 1201
- for Bunt ... 208, 214

Foul-brood, Treatment of Bees for... ... 457

Frauds in Seed Selling ... 1229

Frost—Protecting Young Citrus Trees from 574

Froggatt, W. W.—Annual Report ... 797
- Asopia farinalis ... 489
- Bruchus obtectus ... 488
- Calandra oryzæ ... 484

PAGE.

Froggatt, W. W.—*continued.*
- Granaria ... 485
- Cicadas (Locusts) and their Habits 334, 418
- Echocerus maxillosus ... 486
- Ephestia kuehinella ... 489
- Experiments in Destruction of Grasshoppers with Fungus ... 284
- Fumigating Hedges for Scale and other Insect Pests ... 326
- Insectarium Notes, Hawkesbury Agricultural College... ... 1019
- Insects that Damage Wheat and other Foodstuffs ... 481
- Leeches ... 775
- Locusts and Grasshoppers ... 1102
- Nut-grass Coccid ... 1130
- Orange Borers at Kurrajong ... 400
- Parasites of Meal-worm Beetle ... 487
- Plodia interpunctella ... 490
- Silvanus surinamensis ... 487
- Sitodrepa panicea ... 486
- Sitotroga cerealella ... 491
- Some wood-boring Beetles and their Habits ... 414
- Tinea granella ... 490
- Tenebrio molitor ... 486
- Tenebroides mauritanicus ... 487
- The Potato Moth ... 321
- Tribolium confusus ... 485
- The White Ant City ... 726
- White Ants and Fruit-trees ... 589
- Woolly Aphis or American Blight ... 18

Fruits at Bathurst Orchard... ... 839

Fruit at Hawkesbury Agricultural Orchard 832

Fruit-case, a California ... 1195

Fruit—
- Cold Storage of ... 1182
- Fumigation for Export—Annual Report 875

Fruits for Hay Irrigation Area ... 653

Fruit Inspection under V.D. Act—Annual Report ... 870

Fruit Marks Act, Canadian... ... 475
- Openings for Preserved ... 185
- Preservation at Hawkesbury Agricultural College ... 889

Fruit Trade, Citrus, of Sicily ... 1224

Fruit-tree Boring Beetles ... 671

Fruit-tree Pests, a supposed Remedy for... 1206

Fruit—Varieties at Wagga arranged according to time of Maturity ... 815

Fumigation ... 597
- of Citrus Trees ... 733

Fumigating Citrus Trees in California ... 492
- Hedges for Scale and other Insect Pests... 326
- Tables of quantities of Cyanide, &c., to use in ... 602
- Tents ... 601
- Materials, Prices of ... 374

Fungi grow from Cuttings ... 1072

Furniture Beetle ... 416

Gale, Albert—
- Bee Matters ... 247
- Fish Farming ... 719
- Honey in England... ... 735
- Treatment of Bees for Foul-brood ... 457

PAGE.
Gale, Albert, and H. W. Potts—A new disease in Honeycomb ... 350
Gennys, R. H.—
  Annual Report ... 951
  Dams in gullies for Temporary Water Supply ... 997
  Lessons of the Drought in New England District ... 1161
Germination of large, medium, and small Grains ... 157
Gilder, P. G.—Green Manures for Orchards 887
Glen Innes Experimental Farm—Annual Report ... 951
Golden Drop Maize ... 658
Golden King Maize ... 658
Golden Nugget Maize ... 658
Gorman, C. H.—
  Annual Report ... 929
  Sheep at Wollongbar Farm ... 384
Gorus, J. T.—Annual Report ... 872
Grass—
  American Species ... 582
  Australian Millet ... 581, 921
  Blue ... 580, 581
  Canary ... 583
  Cocksfoot ... 583
  Diplachne fusca ... 581
  Eragrostis tenella ... 608
  Eragrostis nigra ... 987
  Italian Rye ... 583
  Kentuckey Blue ... 583
  Meadow Fescue ... 583
  Meadow Foxtail ... 583
  Mitchell ... 580
  Mitchell Grass Hay ... 579
  Natal Red Top ... 582
  Panicum sp. ... 580, 581
  Paspalum dilatatum ... 262, 582
  at Cootamundra ... 1087
  Paspalum virgatum ... 582
  Perennial Rye ... 583
  Prairie ... 583
  Root system of Mitchell ... 734
  Sheep's Fescue ... 583
  Texan Timothy ... 608
  Timothy ... 583
Grasses at Bathurst Farm ... 921
  Paspalum at Bathurst ... 922
  at Coolabah Farm... ... 942
  Grafton District ... 1157
  Grafton Farm ... 949
  Gundagai District ... 1170
  Hawkesbury Agricultural College ... 1217
  Mudgee District ... 1167
  Murrurundi District ... 1166
  New England District ... 1162
  Riverina District ... 1174
  Wagga Land District ... 1175
  Wagga Farm ... 908, 1173
  Wollongbar Farm ... 935
  Some Native and Exotic at Bathurst Farm 579
  South Coast District ... 1160
  Drought-resistant—Grafton District ... 1157
  English, for a cool climate ... 1202
  Grasses for Trial ... 1127
Grading Cream ... 342
  at Byron Bay Factory ... 344
Grading and harvesting Wheat for Seed... 652
Grading Machinery ... 199
  of various types ... 201
Grafton Farm—Annual Report ... 945
Grain Moths... ... 481-492
  Beetles ... 481-492
  Moth—the Angoumois ... 491
  Stores, Co-operative ... 1149
Grasshoppers—
  Experiments in destruction of ... 284
  and Locusts... ... 1102
Grape Vines—
  Cultivation of ... 610
  At Hawkesbury Agricultural College Orchard ... 834
  Wagga Orchard ... 829
  for Export, Late ... 1101
Green Food for farm horses ... 87
Green Fodder—necessity for, when feeding dry stuff ... 1162
Green Manure Crop, Tares as a ... 180
  Analysis of Field Peas, and Tares or Vetches ... 181
  for Orchards, P. G. Gilder ... 887
  at Howlong... ... 850
  Gauging flow of Rivers ... 292
Guavas at Hawkesbury Agricultural College Orchard ... 839
Guinea Grass, Analysis of ... 935
Guthrie, F. B.—
  Annual Report (1902) ... 794
  Analyses of Field Peas and Tares or Vetches as Green Manure Crops in Orchard ... 180
  Analysis of a locally-manufactured Cattle Food ... 655
  Chemical nature of the Soils of N.S.W., with special reference to Irrigation ... 1079
  Manures for Passion Vines ... 252
Guthrie, F. B., and R. Helms—Pot Experiments to determine limits of endurance of different Farm Crops for certain injurious Substances ... 114
Guthrie, F. B. and A. A. Ramsay—Analyses Commercial Fertilisers, 1903 List ... 313
Hamlyn, Harris, Dr.—*Re* Honey in England ... 735

Hand-feeding
  in Merriwa District ... 1166
  in Murrurundi District ... 1167
  at Wagga Farm ... 1175
Harrowed *v.* Unharrowed Wheat Crops ... 914
Harvesting Broom Corn ... 381
Harvesting—
  Maize Scythe-blade, Implement for ... 172
  Wheat for Seed, Grading and ... 652
Hawkesbury Agricultural College—
  Annual Report ... 876
  A Handy Seed-drill ... 664
  A New Disease in Honeycomb ... 359
  A Supposed Remedy for Fruit-tree Pests 1206
  An Experiment for Farmers ... 258

PAGE.
Hawkesbury Agricultural College—*continued.*
Arrowroot ... 452
The Climbing Cut-worm in Hawkesbury District ... 1203
Construction of Pig-sty Buildings ... 65
Cowpea for Dairy Farmers ... 96
Donors to Prize Fund ... 896
Egg-laying Competition—Twelve Months Test ... 443
Egg-laying Competition—Third (International) ... 1048
Evolution of a Potato ... 1043
Experiments to Determine Loss in Storage of Silage ... 441
Experiments with Cowpeas ... 1118
Experiments with Rape and Swedes (Rape) ... 1208
Experiments at Clarendon Farm ... 261
Farm Notes (see under Farm Notes).
Field Experiments with Maize ... 554
Test of Varieties ... 656
Field Experiments with Potatoes ... 348
Finding Areas of Irregular Blocks of Land ... 767
Insectarium Notes... 1019
Maize Ensilage ... 171
Meteorological Note ... 1047
Notes on Cowpea ... 362
Observations on the late Drought ... 1215
Orchard Annual Report ... 832
Paspalum Seed ... 1045
Potatoes Sprouting in the Ground ... 174
Preparing Maize Ensilage ... 437
Prize List, 1902 ... 896
Quantity Measurements ... 565
Quantity Measurements of Haystacks, Dams, &c. ... 355
Rape Experiments... 573
Rations for Pigs ... 771
Report of Veterinary-Surgeon Pottie on Sheep which had fed on Rush Lily ... 1214
Rye ... 191
Seed Maize—Its Selection and Improvement ... 1037
Seed of Paspalum dilatatum Grass ... 262
Sheep Poisoning at the Hawkesbury Agricultural College ... 1212
Shredded Maize Stalks ... 442
Third (International) Egg-laying Competition ... 667
Use of Plants for Checking Water Evaporation ... 257
Variations in Rainfall ... 345
Hay (Cowpea) Vine ... 91
Hay Crops at Wagga Farm... 914
Hay—
from Native Grasses at Wagga Farm .. 1172
Native Grasses—Varieties to Use ... 1177
For Dairy Fodder ... 1159
Mitchell Grass ... 579
Native Grass at Coolabah Farm... 942
Sorghum ... 175
Withered Maize ... 169
Hayes, J.—Report on Wool at Wagga Farm ... 902
Haystacks, Measuring... 355

PAGE.
Haywood Bros.—Experiments with Oats and Wheat at Pambula ... 724
Hamner, T. W.—Annual Report ... 810
Hawthorn Hedge—Diseases of the... 1068
Hedges—Fumigating for Scale and other Insect Pests ... 326
Helms, R., and F. B. Guthrie—Pot Experiments to Determine Limits of Endurance of Farm-crops for Injurious Substances ... 114
Herd-book—Dairy Shorthorn ... 1116
Honey in England ... 735
Hickory King... 659
Holdsworth, P. J.—Saltbush ... 1001
Hollyhocks—Disease of ... 1061
Honey-comb—A New Disease in ... 359
Honey-producer—The Yellow Box as ... 596
Horses—
Opinion of Lord Kitchener and his Officers on Australian ... 493
Wagga Farm ... 904
Wollongbar Farm ... 936
Green Food for ... 87
Horse Manure—Utilising ... 718
Horse-power—A Handy ... 170
Horse-tooth Maize ... 659
Howlong Viticultural Station — Annual Report ... 850
How Much can the Grower Spend in Grading Seed ... 203
Hudson, C. K.—Lesson of the Drought in Cooma District ... 1169
Humby, A. J.—Drought Fodder (Sorghum) 111

Implements and Profit—Good ... 1198
Improvements at Wagga Farm ... 904
Improvement of Live Stock in Ireland ... 428
Insectarium Notes and Insects found about the Hawkesbury Agricultural College 1019
Insects that damage Wheat and other Foodstuffs ... 481
Instruction, Itinerant, in Agriculture and Dairying in Ireland ... 434
Iowa Silver Mine Maize ... 659
Ireland—
Dairying and Government Assistance ... 426
Improvement of Live Stock in ... 428
Irrigation—
in Egypt ... 1090
in France ... 1097
in India ... 1099
in Italy ... 1098
in New South Wales ... 295
in Spain ... 1098
in the United States ... 1094
in Victoria ... 296
at Bathurst Farm ... 925
Artesian Water at Goodooga ... 110
at Pera Bore ... 1144
Mildura ... 302
Renmark ... 304
Rodney Trust ... 301
The Murray Waters ... 289
The Murray Water and ... 1088
Arid portions of Murray Basin ... 616

Irrigation—*continued.* PAGE.
Irrigable Areas of Murray Basin ... 611
Premiers' Agreement *re* use of Murray Waters ... 613, 1088
Lake Victoria ... 623
Wakool River ... 1089
South Australian Village Settlements ... 305
Yanko Cutting ... 1088
Results of ... 541
Fruits for Hay District ... 653
Lucerne at Jemalong ... 385
Lucerne at Yanko ... 398
For Onions ... 655
Of Orchards ... 538
Paspalum at Jemalong ... 399
Sheep Feeding at Jemalong ... 385
Shepherd's Orchard, Nepean River ... 543
Sorghum at Jemalong ... 398
,, at Yanko ... 398
A Wheat Field in Colorado ... 1095
Chemical Nature of the Soils of N.S.W., with special reference to ... 1078
and Forests ... 328
Means to ameliorate the Conditions of Arid Regions ... 97
Amount of Water required for Crops ... 106
Cost of Water in U.S.A. ... 109
Gunningbar Creek Cutting and Regulator 1090
Check Weir and Drop ... 1098
Drop in Canal ... 1100
Flume for Measuring Miners' Inches ... 1096
Flume across a sidehill cut ... 1093
Flume on a rock hillside ... 1097
Levelling Land ... 541
Locks and Weirs ... 308
Methods ... 105
Pipe under 160-foot head, Santa Anna Canal, Cal. ... 1094
Requirements for Water Storage ... 104
Storages ... 618
Timber Regulator ... 1001
Trapezoidal or Cippoletti Weir ... 1099
Water Channels ... 538

Jackson, H. V.—
Annual Report ... 865
Cold Storage and Export Branch ... 865
Cold Storage of Eggs ... 713
Export of Prize Mutton ... 242
Market Review—
January ... 94
February ... 188
May ... 478
July ... 677
August ... 780
November ... 1137
Soil Deterioration and Erosion ... 139
Japanese Plums—
at Hawkesbury Agricultural College Orchard ... 837
at Wagga Orchard ... 828
Judging at Agricultural Shows ... 533
Open ... 534
Kaleski, Robt.—Cattle Dogs ... 752
Kerry Cows—Milk Records at Berry Farm 235
King, F. C.—Cinquatina Maize ... 1135

PAGE.
Klondyke Maize ... 659
Kurrajong ... 17
Kurrajong Trees, growing from seed ... 220

Lakes Alexandrina and Albert ... 308
Lance, C. C.—
Packing of Butter for Export ... 751
Report on the Universal Hygienic Milk Exhibition, Hamburg ... 759
Larkspur—Diseases of ... 341, 1065
Lease of Bulls to Dairy Farmers in Ireland 427
Leguminous Crops at Bathurst Farm ... 920
Leaf Curl of the Potato ... 978
Leaf-mining Fly and Parasites ... 1024, 1025
Leguminous Crops at Wagga ... 906
Lemon Trees losing their leaves ... 272
Lemons—
at Hawkesbury Agricultural College Orchard ... 834
Decaying while on the Market ... 969
Export of, from Sicily ... 1224
Melanose ... 967
Lessons of the Drought ... 1157
Bombala District ... 1169
Cooma District ... 1169
Deniliquin District ... 1176
Forbes District ... 1168
Grafton District ... 1157
Gundagai District ... 1169
Hawkesbury Agricultural College ... 1215
Macleay River District ... 1158
Merriwa District ... 1166
Moree District ... 1163
Mudgee District ... 1167
Murrurundi District ... 1166
Riverina District (Wagga Farm) ... 1171
South Coast District ... 1159
Warialda District ... 1165
Wagga Land District ... 1175
Letters on the Diseases of Plants ... 627, 681, 955
Linseed—
at Wollongbar Farm ... 932
for young Calves ... 1153
Liquid Manure—On the Value of ... 462
List of Agricultural Society Shows (See A.) 954
Lita solanella ... 321
Locusts—
Blue Mountain ... 1105
Experiments in destruction of ... 284
and Grasshoppers ... 1102
Green-streaked ... 1106
Green-striped ... 1110
Large Coast ... 1106
Large Mottled ... 1106
Red-legged ... 1109
Small Plain ... 1106
The Variable ... 1109
Yellow-winged ... 1104
Longfellow Dent Maize ... 606
Loquat—Black-spot or Fusicladium of ... 1058
Loquats—
at Hawkesbury Agricultural Orchard ... 838
at Wagga Orchard ... 821
Lowe, W. H.
Lessons of the Drought, Merriwa District 1166

PAGE.

- Lucerne—
  - as a Drought Stand-by ... ... 1162, 1179
  - as provision against Drought ... .. 1154
  - in arid country—Sowing and Cultivation of ... ... ... ... ... ... 652
  - at Bathurst Farm ... ... ... ... 920
  - in Deniliquin District ... ... ... 1177
  - in Mudgee District ... ... ... 1167
  - at Pera Bore ... ... ... ... 1147
  - at Wagga Farm ... ... ... ... 903
  - at Wollongbar Farm ... ... ... 932
  - for Dairy Farmers ... . . ... ... 1159
  - under Irrigation at Jemalong ... ... 391
- Lucerne Tree, The ... ... .. ... 1233
- Lung Disease in Calves ... ... ... 1

- Macaroni Wheats ... ... ... ... 1073
- Macrosporium of the Passion-vine... ... 971
- Machine for—
  - crushing Apples for Cider ... ... 275
  - harvesting Maize for Ensilage ... ... 439
  - shredding Maize-stalks ... ... ... 442
- Machinery at Wagga Farm... ... ... 904
- Mal di goma of Lemon trees ... ... 272
- Maiden, J. H.—
  - Annual Report ... ... ... ... 857
  - Eragrostis nigra ... ... ... ... 987
  - Eragrostis tenella ... ... ... ... 607
  - Geo. Caley ... ... ... ... ... 988
  - Frauds in Seed-selling . . ... ... 1229
  - Growing Kurrajong trees from Seed ... 220
  - Notice to Farmers, Pastoralists, and Land occupiers *re* Specimens for National Herbarium ... .. .. ... 1181
  - Some so-called Fodder plants not always edible .. ... ... ... ... 765
  - Stock and Stringybark trees .. ... 1002
  - Texan Timothy ... ... ... ... 608
  - Useful Australian Plants... ... ... 987
    - Eragrostis nigra... ... ... ... 987
    - Eragrostis tenella ... ... ... 607
    - Panicum helopus ... ... ... 241
- Maize Beetle, The Underground ... ... 1022
- Maize Crops—
  - at Bathurst Farm ... ... ... ... 918
  - at Glen Innes Farm .. ... ... 953
  - at Hawkesbury Agricultural College ... 1049
  - at Wagga Wagga Farm ... ... ... 912
  - at Wollongbar Farm ... ... ... 932
- Maize—
  - Check *v.* Drill Planting ... ... ... 555
  - Cinquatina ... .. ... ... ... 1135
  - Description and Illustration Varieties ... 656
  - Ensilage at Hawkesbury Agricultural College... ... ... ... ... 437
  - Ensilage ... .. .. ... ... 171
  - Field Experiments with at Hawkesbury Agricultural College ... ... ... 554
  - Fodder ... ... ... ... ... 774
  - for distribution—
    - Golden Beauty ... ... ... ... 1036
    - Hickory King ... ... ... ... 1036
  - Harvesting for Ensilage—Scythe-blade Cutter .. ... ... ... ... 172

PAGE.

- Maize—*continued.*
  - Hill Cultivation *v.* Flat Cultivation ... 558
  - A New ... ... ... ... ... 1036
  - Selection and Improvement of Seed ... 1037
  - Shredded Stalks ... ... ... ... 442
  - Treatment of Withered ... .. ... 169
  - Trench planting *v.* Level planting ... 557
  - Trial of Varieties ... ... ... ... 559
    - for fodder... ... ... ... ... 563
    - Order of Maturity ... ... ... 565
    - Yield ... ... ... ... ... 565
  - for Grain—Order of Maturity ... ... 559
    - Yields ... .. .. ... ... 561
- Malting, on the growing of Barley for ... 1222
- Mandarins at Hawkesbury Agricultural College Orchard ... ... ... ... 834
- Mangolds at Bathurst Farm ... ... 926
- Manure—
  - Experiments with Cowpeas ... ... 1121
  - Liquid, on the value of ... ... ... 462
  - Tares as a Green Crop ... ... ... 180
  - Utilising Horse ... ... ... ... 718
- Manures—
  - Analysis of 1903 List ... ... ... 313
  - Comparisons of, at Wagga Wagga Farm 914
  - for Passion-vines ... ... ... ... 252
  - Varying Quantities of, at Wagga Wagga Farm ... ... ... ... ... 915
- Market Gardeners—Co-operation amongst Dutch ... ... ... ... ... 310
- Market Gardening—Schools for ... ... 312
- Market Review—
  - January ... ... ... ... ... 94
  - February ... ... ... ... ... 188
  - May ... ... ... ... ... ... 478
  - July ... ... ... ... ... ... 677
  - August ... ... ... ... ... 780
  - November ... ... ... ... ... 1137
- Martin J.—Annual Report ... ... ... 870
- Mastodon, Early Dent ... ... ... 660
- Matthews, W. H.—Paspalum dilatatum at Cootamundra ... ... ... ... 1087
- McKay, R. I.—
  - The Murray Waters and Irrigation 289, 611, 1088
  - Pollution of River Waters ... ... 623
- McKeown, G. M.—
  - Annual Report ... ... ... ... 900
  - Crops at Wagga Wagga Farm ... ... 408
  - Farm Notes—Riverina District. (See under F.)
  - Lessons of the Drought in Riverina District ... ... ... ... ... 1171
- Meal Moth ... ... ... ... ... 489
- Meal-worm .. ... ... ... ... 486
- Measuring Haystacks, Dams, Stone-heaps, &c. ... ... ... ... ... 355
- Measuring Irregular Blocks of Land ... 767
  - Irregular-shaped Areas of Land... ... 565
- Medlars at Hawkesbury Agricultural College Orchard ... ... ... ... 839
- Melanose ... ... ... ... ... 966
- Melon—
  - A New Preserving... ... ... ... 587
  - Cultivation of ... ... ... ... 1234
- Meteorological Note ... ... ... ... 1047

PAGE.
Milk—
Bacteriology in Europe ... 761
Concentrating ... 762
Condensed ... 30, 221
Condensed *v.* Concentrated ... 222
Exhibition, Report on the Hamburg ... 759
Filters ... 762
Homogeneised ... 761
Preservation (aeration) in Europe ... 761
Record of Imported Cows at Wollongbar Farm ... 238
Kerry Records at Berry Farm ... 235
Records, Tring Park ... 238
Returns at Wollongbar Farm ... 939
Milk-testing appliances ... 764
Milking Machine, Lawrence-Kennedy ... 63
Mitchell Grasses ... 921
Mitchell Grass, Root—System of ... 734
Millets—
at Bathurst Farm ... 918
at Coolabah Farm ... 942
at Grafton Farm ... 947
Hawkesbury Agricultural College ... 1217
at Wagga Farm ... 912
Wollongbar Farm ... 933
Millet (Broom) Harvesting ... 381
Mohair ... 1032
Moree Irrigation Farm—
Annual Report ... 943
Orchard Annual Report ... 846
Mosquitoes, Keeping at Bay ... 475
Moth—
The Angoumois Grain ... 491
Cotton-Boll Moth ... 1021
Convolvulus Hawk-moth ... 1019
Forest Bag Moth ... 1022
Meal ... 489
Mediterranean Flour ... 489
Painted Acacia ... 1022
Ribbed Case Moth ... 1021
Soy Bean ... 1023
The Wolf ... 490
Mouldy Core of the Apple ... 705
Muggridge, W.—Open Judging ... 534
Mulligan, T. P.—Lessons of the Drought, Wagga Land District ... 1175
Musson, C. T.—
Annual Report ... 879
Arrowroot ... 452
The Evolution of a Potato ... 1043
Meteorological Note ... 1047
Notes on Cowpea ... 362
Paspalum Dilatatum Seed ... 262
Paspalum Seed Again ... 1045
A Supposed Remedy for Fruit-tree Pests 1206
Use of Plants for Checking Water Evaporation ... 257
Variations in Rainfall at Hawkesbury Agricultural College ... 345
Mustard at Bathurst Farm ... 922
Murray Basin, Area of ... 290
Arid Portions of ... 616
Irrigable Areas of ... 611
Murray Waters, The ... 289
Murray Waters and Irrigation ... 1088
Tributaries ... 291
Corowa Conference ... 291

PAGE.
Murray Waters and Irrigation—*continued.*
Gauging flow ... 292
Navigation ... 306
Premiers' Agreement ... 613
Modification of Premiers' Agreement ... 1088
Relative Contributions to Volume by N.S.W. and Victoria ... 293
Royal Commission ... 291
Storages ... 618
Mutton—
Export of, to London ... 1232
Export of Prize ... 242

Native Fodder Plants—Growing Kurrajong trees from seed ... 220
Native Studies—White Ants ... 726
Navigation—
of Murray and Darling Rivers ... 305
Amounts expended by New South Wales and Victoria in maintaining ... 307
Nectarines at—
Hawkesbury Agricultural College Orchard 835
Wagga Orchard ...
Newell, F. H.—Review of his book on "Irrigation in the United States of America" ... 97
Nichols, G. R.—Cinquatina Maize ... 1136
Nuts at Hawkesbury Agricultural College orchard ... 839
Nut-grass Coccid ... 1130

Oats—
at Bathurst Farm ... 917
at Glen Innes ... 952
at Grafton Farm ... 949
at Hawkesbury Agricultural College ... 1217
at Pambula ... 724
at Wagga Wagga Farm ... 912
at Wollongbar Farm ... 933
Trial of, at Bathurst ... 412
Classification of varieties as to earliness, height, and other properties ... 412
O'Callaghan, M. A.—
Annual Report ... 804
Bulls for dairy-farmers in Ireland ... 426
Butter exhibits at the Royal Agricultural Society's Show, 1903 ... 550
Calf-rearing experiments in Ireland ... 1111
Composition of Condensed Milks ... 225
Condensed Milk ... 30, 221
Technique of Manufacture ... 226
Condensed *v.* Concentrated Milk ... 222
Cheese *v.* Butter ... 233
Cream-grading ... 342
Dairy Bull ... 1114
Dairy Bulls ... 64
Dairy Conference ... 342
Dairy Notes ... 227, 342, 550, 1114
Dairy Notes and News ... 63
Departmental Encouragement of Improvement of Live Stock in Ireland ... 428
Departmental work in Ireland ... 426
Detection of Formalin in Butter made from Cream to which Formalin has been added ... 1201

PAGE.

O'Callaghan, M. A.—*continued.*
- Duplicate Butter Entries at Agricultural Shows ... 343
- Fifth State Butter Show ... 227
  - Conditions and Regulations ... 227
  - Faults in Manufacture ... 229
  - Flavour ... 231
  - Mottled Butter ... 231
  - Packing ... 230
  - Results ... 228
- Government Assistance to Dairying and other Branches of Agriculture in other Countries ... 426
- Grading Cream ... 236
- Grading Cream at Byron Bay ... 344
- Itinerant Instruction in Agriculture and Dairying in Ireland ... 434
- Lease of bulls to Irish Dairy Farmers ... 427
- Linseed for Young Calves ... 1153
- Milking Machine ... 63
- Premiums for Bulls for Dairy Farmers in Ireland ... 427
- Storing of Butter ... 64
- Subsidy to Agricultural Societies in Ireland ... 431
- Water for Dairy Purposes ... 1003

Olives at—
- Hawkesbury Agricultural College Orchard 839
- Wagga Wagga Orchard ... 822

Onions—
- at Bathurst Farm ... 923, 926
- Disease of ... 980
- Irrigation for ... 655

Orchard Notes—
- January ... 86
- February ... 179
- March ... 273
- April ... 371
- May ... 456
- June ... 575
- July ... 672
- August ... 773
- November ... 1129
- December ... 1228

Orchards—
- Tares for Green Manure Crop ... 180
- Green Manures—Analysis of crops for ... 181

Orchard at—
- Moree ... 943
- Wagga Wagga—Annual Report ... 813

Orchard Pests—Woolly Aphis ... 18

Orange Borers at Kurrajong ... 400

Oranges—
- Export of, from Sicily ... 1224
- at Hawkesbury Agricultural College Orchard ... 833

Our Forestry Problem ... 593

Ovary and Oviduct of a Laying Hen ... 128

Palmer, P. W. C.—Lessons of the Drought in Gundagai District ... 1169

Palmer, H. C.—Lessons of Drought, Macleay River District ... 1158

Panicum helopus ... 241

Parasite—Orange Butterfly ... 1024

PAGE.

Paspalum dilatatum ... 582
- Seed ... 262, 1045
- at Bathurst ... 922
- at Cootamundra ... 1087
- at Grafton ... 949
- at Hawkesbury Agricultural College ... 267-8
- under Irrigation ... 399

Paspalum virgatum ... 582

Parsnip Seed—Vitality of ... 10

Passion Vine—
- Diseases of ... 970
- Faulty Leaves ... 973
- Manures for ... 252
- Pleospora ... 972
- A Ripe-rot Fungus ... 976

Pasteurisation—
- for Butter-making ... 763
- and Sterilisation in Europe ... 760

Pastoral and Agricultural Societies' Union Conference ... 477, 526

Parasites of Meal-worm Beetle ... 487

Pasture, Rape for Pigs ... 468

Pathologist, Annual Report ... 793

Peaches—
- at Bathurst Orchard ... 844
- at Hawkesbury Agricultural College Orchard ... 835
- at Wagga Orchard ... 822

Peach Curl ... 956

Peach Elberta (Col. Plate) ... 374

Peacock, R. W.—
- Annual Report (Bathurst) ... 916
- Annual Report (Coolabah Farm) ... 941
- Farm Notes—Bathurst District. See under F.
- Making Bush-hay ... 1177
- Trial of Oats at Bathurst Farm, 1902-3 ... 412
- Mitchell Grass, Root-system ... 734
- Quantity of Wheat to sow per Acre ... 217
- Some Native and Exotic Grasses at Bathurst Farm ... 579
- Wheats at Bathurst Farm ... 327

Peanuts—
- at Bathurst Farm ... 923
- at Wollongbar Farm ... 933

Pear—Keiffer's Hybrid (Col. Plate) ... 374

Pears—
- at Bathurst Orchard ... 845
- at Hawkesbury Agricultural College Orchard ... 837
- at Wagga Orchard ... 824

Pedersen, C.—
- Annual Report ... 809
- Ventilation in Dairies ... 588

Pera Orchard—Annual Report ... 846

Persimmons at Hawkesbury Agricultural College ... 839

Phaseolus Beans ... 467

Phylloxera-resistant Vines and Stocks 240, 849
- Distribution of ... 476

Pigs—
- at Bathurst Farm ... 928
- at Wagga Wagga Farm ... 905
- at Wollongbar Farm ... 936
- The Brood Sow ... 370
- Cutting up Carcase for Pork and Bacon 382

PAGE.
Pigs—*continued.*
  for the Destruction of Codlin Moth Grubs 1077
  Rape for 468
  Rations for 771
  Scalding 606, 1117
  Swine-fever 464, 737
  Wheat as Food for 592
Pig Stud at Hawkesbury Agricultural College—Annual Report 892
Pig-sty Buildings—Construction of 65
Pineapples at Grafton Farm 948
Pineapple Wine 1231
Pleospora on Passion Vines 972
Plums—
  at Bathurst Orchard 845
  at Hawkesbury Agricultural College Orchard 837
  at Wagga Orchard 826
Poisoning Sparrows 286
Pollock, D.—Artesian Water at Goodooga 110
Pollution of River Waters 623
Pomegranates at Hawkesbury Agricultural College Orchard 839
Pork and Bacon for Home Use, Preparing 382
Post Mortem Appearances 744
Potato, the Evolution of a 1043
Potato Moth 321
Potatoes—
  Disease in Seed 985
  Field Experiments with, at Hawkesbury Agricultural College 348
  Sprouting in the Ground 174
  Storing 470
  Trials of Planting—Shallow *v.* Deep 349
  Fertiliser Trials 350
  Test of Varieties 353
  at Bathurst Farm 925
  at Glen Innes Farm 953
  at Wagga Farm 912
  at Wollongbar Farm 934
  Pottie, Stuart—Report on Sheep which died at Hawkesbury Agricultural College Farm 1214
Potts, H. W.—
  Annual Report 876
  Climbing Cut-worm in Hawkesbury District 1203
  Farm Notes—Hawkesbury District. See Farm Notes.
  Maize 1049
  Maize Ensilage 171
  Observations on the Drought 1215
  Preparing Maize Ensilage at Hawkesbury Agricultural College 437
  Rye 191
  Sheep-poisoning at the Hawkesbury Agricultural College 1212
  Shredded Maize Stalks 442
Potts, H. W., and A. Gale—A new disease in Honeycomb 359
Potts, Cuthbert—
  Annual Report 879
  Finding Areas of Irregular Blocks of Land 767
  Quantity Measurements of Haystacks, Dams, &c. 355

PAGE.
Poultry—
  American, in Egg-laying Competition 669
  Composition, Formation, and Production of Eggs 127
  Egg-laying Competition Hawkesbury Agricultural College—Results of 12 months test 443
  Egg-laying Competition at Hawkesbury Agricultural College—Third (International) 1048
  Report on Characteristics of Fowls in Egg-laying Competition at Hawkesbury Agricultural College 446
  Exportation of, to Victoria 1117
  at Hawkesbury Agricultural College—Annual Report 892
  at Wagga Farm 905
  New Breeds and Varieties of Fowls 121
  Ovary and Oviduct of Laying Hen 128
Powder-keg Longicorn 417
Preedy, Walter—
  Drought Statistics 1178
  Notes on Agricultural Statistics 716
Premiums for Dairy Bulls in Ireland 427
Preservatives—
  in Condensed Milk 32
  Antiseptic Properties of Boric Acid 223
Preserving—
  Eggs 472
  Eggs in Waterglass Solution 676
  Fruit—Apples—Bottling 126
  Melon, a New 587
Preserved Fruit, Openings for 185
Prices paid for Remounts 504
Prickly Pear as a Drought Fodder, Warialda District 1165
Pride of the North Maize 661
Prize, Special for Collection Commercial Timbers 144
Producing Beef on Farms 401
Prunes at Bathurst Orchard 846
  Hawkesbury Agricultural College Orchard 838
  Wagga Orchard 826
Pulp, Apricot 14
Pumpkins at Wagga Farm 905

Quantity Measurements of Haystacks, Dams, &c. 355
Quinces—
  at Hawkesbury Agricultural College Orchard 838
  at Wagga Orchard 828
  Black Rots or alternaria of the 712
  Rots 709
Quirk, P.—
  Calf Stall Feeders 239
  Lessons of the Drought, South Coast District 1159

Rainfall—
  at Bathurst Farm 916
  at Coolabah Farm 941
  at Grafton Farm 945

PAGE.

Rainfall—*continued.*
  at Hawkesbury Agricultural College, Variations in ... ... ... ... 345
  at Hawkesbury Agricultural College, 1890-1902 ... ... ... ... 1215
  at Moree Farm ... ... ... ... 944
  at Wagga Farm ... ... ... 411, 915
  at Wollongbar Farm ... ... ... 930
Ramsay, A. A., and F. B. Guthrie, Analyses of Commercial Fertilisers ... ... 313
Rape—
  Broadcast and Drilled, at Hawkesbury Agricultural College ... ... ... 1208
  at Bathurst Farm ... ... ... ... 922
  Experiments at Hawkesbury Agricultural College ... ... ... ... ... 573
  for Greenstuff ... ... ... ... ... 572
  for Pigs ... ... ... ... ... ... 468
  at Wagga Farm ... ... ... ... 913
Rations—
  for Calves, Experiments in Ireland ... 1111
  for Pigs ... ... ... ... .. 771
Reay, D. H.—Annual Report ... ... 895
Red Hogan Maize ... ... ... ... 661
Relative Fodder Value of large and small Grains of Wheat ... ... ... 145
Report on Crops from Experimental Packets of Seed ... ... ... ... ... 724
Rice at Grafton Farm ... ... ... 947
Riley's Favourite Maize ... ... ... 661
Ringbarking Trees—Cattle and Horses 1156, 1235
Ripe Rot ... ... ... ... 628
Rock Melons at Wagga Farm ... ... 911
Romney Marsh Sheep at Wollongbar Farm 584
Rose, Black Spot of .. ... ... ... 1063
Root Galls as Cow-pea ... ... ... 362
Root Rots and Timber Rots... ... .. 981
Root-system of Mitchell Grass ... ... 734
Rotation of Crops at Bathurst Farm ... 925
Rots of the Quince ... ... ... ... 709
Row System ... ... ... ... ... 147
Royal Commission on Murray Waters ... 291
Russian and Siberian Butter in London ... 461
Rye ... ... ... ... ... ... ... 191
  at Bathurst Farm... ... ... ... 918
  at Wollongbar Farm ... ... ... 934
  Emerald, at Millthorpe ... ... ... 367

Sabine, C. W.—Report on Drought Lessons, Grafton District... .. ... ... 1157
Sacchaline at Bathurst Farm ... ... 924
Salt (Common) Effects of, on Crops ... 115
Saltbushes at Bathurst Farm ... ... 924
  American, at Bathurst Farm ... .. 928
  at Coolabah Farm ... ... ... ... 942
  Paddocks at Coolabah Farm ... ... 942
  Experiment at Grafton Farm ... ... 950
  at Parkes .. ... ... ... ... 1001
  at Pera Bore Farm... ... ... ... 1147
  at Wagga Farm ... ... ... ... 910
  Wagga Land District ... ... ... 1176
Sanderson, W.—Annual Report ... ... 873
Scalding Pigs ... ... ... ... ... 606

PAGE.

Scale—
  Spraying Apple-trees for San José ... 461
  Insects, Fumigating Hedges for .. ... 326
Scythe-blade Implement for Cutting Maize Crops ... .. ... ... ... 172
Section Cradles, Wire, for Bee-hives ... 249
Seed-drill, a Handy ... ... ... .. 664
Seed Maize—Its Selection and Improvement 1037
Seed—Paspalum dilatatum ... ... .. 262
Seed Selling, Frauds in ... ... ... 1229
Seed-testing at Hawkesbury Agricultural College ... ... ... ... .. 261
Seed—Varying Quantities of, at Wagga ... 915
Seed Wheat ... ... ... ... 33, 145, 193
  Quantity to Sow per Acre ... ... 217
Sheep—
  Anthracoid ... ... ... ... ... 16
  at Bathurst Farm ... ... ... ... 928
  Dentition and Definition of Age... ... 731
  Diseases in (Stranguary) ... ... ... 15
  for the Farmer .. ... ... ... 11
  Feeding at Jemalong ... ... ... 385
  at Glen Innes Farm ... ... .. 953
  Poisoning at the Hawkesbury Agricultural College ... ... ... ... 1212
  Report of Vet.-Surgeon Pottie on Yellow Rush Lily ... ... ... .. 1214
  at Wagga Farm ... ... ... ... 901
  at Wollongbar Farm ... ... ... 584
Sheep's Burnet—
  at Bathurst Farm ... ... ... ... 923
  at Hawkesbury Agricultural College ... 1217
  at Wagga Farm ... ... ... ... 903
Shoalhaven No. 1, Maize ... ... ... 661
Shoalhaven No. 2 ... ... ... ... 662
Shorthorn Handbook (Dairy) ... ... 1116
Shothole Stigmonose... ... ... ... 696
Shredded Cornstalks at Hawkesbury Agricultural College ... ... ... ... 1218
Silage—
  Loss in Storage and Handling ... ... 441
  Maize ... ... ... ... ... 171
  Preparing Maize, at Hawkesbury Agricultural College .. .. .. .. 437
Sisal Hemp at Grafton Farm ... ... 949
Six-weeks' Maize ... ... ... ... 662
Snow Fly, The ... ... .. ... 1026
Sodium Carbonate, Effects of, on Crops ... 116
Sodium Chlorate, Effects of, on Crops ... 118
Soils of N.S.W., Chemical Nature of, with Special Reference to Irrigation ... 1078
Soils of and Regions, Richness of ... ... 1091
Soil Deterioration and Erosion ... ... 139
Sorghum—
  at Bathurst Farm ... ... ... ... 919
  at Coolabah Farm ... ... ... ... 942
  at Hawkesbury Agricultural College ... 127
  at Wagga Farm ... ... ... ... 906
  at Wollongbar Farm ... ... ... 934
  as a Drought Fodder Crop ... ... 111
  under Irrigation, at Jemalong, Yanko ... 398
  Hay ... ... ... ... ... ... 175
Sparrows—
  Concerted Action in Poisoning ... ... 1124
  Destruction of ... ... ... ... 286
Star Leaming Maize ... ... ... ... 662

PAGE.
Stanley, E.—Swine-fever ... 464
Stacking Cowpea-vine Hay ... 91
Statistics—
  Notes on N.S.W. Agricultural ... 716
  Drought ... 1178
Steam—Effects of on Vitality of Seeds and Spores ... 26
Stewart, J. D.—
  Swine Fever ... 737
  White Scour or Lung Disease in Calves 1
Stigmonose ... 692
  Shot-hole ... 696
Stock-Feeding, Starving, at Moree Farm 944
  at Hawkesbury Agricultural College in dry seasons ... 1218
  and Stringybark Trees ... 1002
Stores for Grain, Co-operative ... 1149
Storing Potatoes ... 470
Stores at Hawkesbury Agricultural College 442, 1218
Stranguary in Sheep... 15
Strawberries at Bathurst Farm ... 927
  and Potash Salts ... 715
Straw at Wagga Farm ... 913
Subsidies to New South Wales Agricultural Societies ... 859
Subsidy to Agricultural Societies in Ireland 431
Sugar-beet at Wollongbar Farm ... 931
Sugarcane at Wollongbar Farm ... 934
Sugar of Lead as a Poison for Sparrows ... 286
Sulphur, Adulteration of ... 1071
Sunflowers at Bathurst Farm ... 923
  at Grafton Farm ... 948
Suter, P. H.—Annual Report ... 888
Sutton, G. L.—
  Annual Report ... 884
  Cowpea for Dairy Farmers ... 96
  Experiments with Cowpeas ... 1118
  An Experiment for Farmers ... 258
  Experiments with Rape and Swedes ... 1208
  Field Experiments with Maize ... 554
  Field Experiments with Maize—Test of varieties ... 656
  Field Experiments with Potatoes ... 348
  A handy Seed-drill ... 664
  Seed Maize—Its selection and improvement ... 1037
  Rape Experiments ... 573
  A new Preserving Melon ... 587
Sweet Potatoes at Wollongbar Farm ... 934
Swine Fever ... 464, 737
  Fatality of the Disease ...
  History ... 737
  Measures for Prevention and Suppression 749
  Nature and Cause ... 739
  Symptoms ... 740
Tares—
  Analysis of ... 181
  at Bathurst Farm ... 921
  as Green Manure in Orchards ... 180
Teeth of Sheep ... 731
Timber Supplies of United Kingdom ... 595
Timber Rots and Root Rots ... 981
Timbers—Special Prize for Best Collection Commercial ... 144
Thinning Tomatoes to increase size of Fruit 187

PAGE.
Thomson, B. L.—Annual Report ... 943
Thompson, D. S.—
  Annual Report ... 892
  Egg-laying Competition—Third (International) ... 1048
  Third (International) Egg-laying Competition ... 667
  Twelve Months' Test Egg-laying Competition ... 443
Thrips, Black ... 10, 24, 1027
Tomatoes—
  at Bathurst Farm ... 927
  at Wagga Farm ... 910
  Holmes' Supreme ... 379
  Thinning to increase size of ... 187
Turnips—
  at Bathurst Farm ... 923
  at Wagga Farm ... 912
Trefoil at Wagga Farm ... 909

Unfermented Wine, making ... 256
Universal Nomenclature of Wheat ... 546
Useful Australian Plants—
  Eragrostis nigra ... 987
  Panicum helopus ... 241

Valder, Geo.—Cheese in South Africa ... 998
Van Weenen, E. D. E.—
  Dentition and Definition of Age (Sheep) 731
  Sheep for the Farmer ... 11
Variations in Rainfall at Hawkesbury Agricultural College ... 345
Varieties of the Vine ... 473
Vegetable and Flower-growing—
  January ... 89
  February ... 182
  March ... 276
  April ... 375
  May ... 458
  June ... 507
  July ... 674
  August ... 776
  October ... 1052
  November ... 1131
Vegetable Garden Crops at Bathurst Farm 926
Vegetation Diseases Act—Annual Report of Inspectors ... 870
Vetches—
  Analysis of ... 181
  at Bathurst Farm ... 921
  at Wagga Farm ... 907
Ventilation in Dairies ... 588
Vines—
  at Hawkesbury Agricultural College Orchard ... 834
  at Wagga Orchard ... 829
Vine, Varieties of the ... 473
Vine Stocks—
  Phylloxera-resistant ... 240
  Distribution of Phylloxera-resistant ... 476
Vineyards, Cultivation of ... 609
Viticultural Station, Howlong—Annual Report ... 848
Vitality of Seeds and Spores—Effects of Engine-boiler Steam on ... 26

PAGE.
Wagga Experimental Farm—
  Annual Report ... 900
  Wheat Crops ... 408
Walnuts—
  at Bathurst Orchard ... 846
  Diseases of ... 977
Water—
  for Bacteriological Analysis—How to take a sample ... 1018
  Conservation for Drought ... 1161
  for Dairy Purposes ... 1003
Waterglass Solution—Preserving Eggs in... 676
Water Holes and Courses—Clearing ... 1158
Water-melons at Wagga Farm ... 911
Wattles at Wollongbar Farm ... 936
Weevil—
  Buff-coloured Bean ... 488
  Wingless Grain ... 485
  The Winged Rice Weevil ... 484
  in Wheat ... 483
Weir, J. R.—Lessons of the Drought in Deniliquin District ... 1177
Wheats—
  at Bathurst Farm ... 916
  at Bathurst Farm, season 1902 ... 327
  at Coolabah Farm ... 941
  at Glen Innes ... 952
  at Grafton Farm ... 948
  at Hawkesbury Agricultural College in Dry Seasons ... 1216
  at Moree Farm ... 943
  at Pambula ... 725
  for Parkville ... 461
  at Pera Bore ... 1146
  at Wagga Farm ... 408, 913
  for Grain at Wagga ... 411
  for Hay at Wagga Farm ... 410, 914
  at Wollongbar Farm ... 934
Wheat-seed—
  Investigation and Discussion of relative value of Large Plump and Small Shrivelled Grains ... 33, 145, 193
  New South Wales Seed Wheat ... 36
  The Grading of Seed Wheat ... 198
  Sieves and Meshes for Grading ... 200
  Large Plump *v.* Small and Shrivelled Seed 147
  Discussion of Various Trials ... 165
  Irregularity of Stand from Ungraded Seed 193
  Samples of New South Wales Seed Graded to Show Quality... 38
  Conclusions ... 204
  Universal Nomenclature ... 546
  Aleuron Layer—Biological Investigation of ... 546
  How much can the Grower afford to spend in Grading Seed... 203
  Sections of a Grain of Wheat (col. plate) 548
  for Seed Grading and Harvesting ... 652
  Quantity to Sow per acre... 217

PAGE.
Wheat-seed—*continued.*
  Macaroni ... 1073
  as Food for Pigs ... 592
  Federation and Jonathan at Parkville ... 461
Wheat Experimentalist—Annual Report... 852
Wheat Experiments—
  Bathurst Farm ... 853
  Coolabah ... 852
  Hawkesbury ... 852
  Lambrigg ... 855
  Wagga ... 853
Wheats—
  Productiveness of Cross-breds ... 1235
  Bleached, and Weevils ... 483
  Bunt Experiments (Farrer) ... 206
Wheat—
  in Hawkesbury District Attacked by Climbing Cut-worm ... 1203
  Comparison of Varieties ... 915
  Comparison of Varieties at Wagga Farm 411
  and Foodstuffs—Insects that damage ... 481
  The Cadelle... 487
Wheat Diseases—Effect of Engine-boiler Steam on Vitality of Seeds and Spores 26
  Effects of injurious Substances on Germination and Growth ... 120
    Ammonium sulphocyanide ... 117
    Arsenious Acid ... 119
    Common Salt ... 115
    Sodium Carbonate ... 116
    Sodium Chlorate ... 118
Wheat Yield Returns ... 1148
White Ants attacking Fruit-trees ... 589
White Ant City, The ... 726
White Horse-tooth Maize ... 663
White Scour in Calves ... 1
Wine Fermentation—Ways to control Temperature of ... 135
Wine—
  Must Refrigerator (Guilleband) ... 137
  Making Unfermented ... 256
  Stability of Colouring Matter in Red ... 55
  Stability of Colouring Matter in Red ... 134
Wine-cask Beetle ... 414
Wood-boring Beetles and their Habits ... 414
Woodiness of the Passion-vine ... 971
Wolf Moth ... 490
Wollongbar Farm—
  Annual Report ... 929
  Sheep at ... 584
Wollongbar Orchard—Annual Report ... 847
Wool at Wagga Farm ... 902
Woolly Aphis or American Blight... 18

Yellow Dent Maize ... 662
Yellow Hogan Maize... 663
Yellow Rush Lily as a dangerous Plant at Hawkesbury Agricultural College ... 1213
Yield of Maize, Potato, and Fruit Crops—Report on... 537

VOL. XIV. PART 1. JANUARY, 1903.

*Agricultural Gazette of New South Wales.*

# "White Scour" and "Lung Disease" in Calves.

J. D. STEWART, M.R.C.V.S.,
Government Veterinary Surgeon.

THE disease affecting calves known as "White Scour" has been recognised for a considerable period. In the early part of last century (1838) an article appeared in the *Veterinarian*, describing a violent diarrhœa with inflammation of the umbilicus affecting calves and foals.

The geographical distribution of the disease appears extensive, as literature indicates that it is known almost throughout the British Islands, and is also common in France, Germany, Denmark, and other European States.

The infectious nature of the disease was early recognised, and many observers directed their attention mainly to the discovery of the causal microbe. The most recent investigations recorded are those carried out last year in Ireland by Professor E. Nocard, of the Alfort Veterinary College, and in France by MM. Lesage and Delmer. These authorities, working on very similar lines, arrived at almost identical conclusions, *i.e.*, that the disease is caused by an ovoid bacterium which penetrates the system by way of the newly ruptured umbilical cord. Their observations also established the fact that the "Lung Disease" is closely related to the disease known as "White Scour."

According to information supplied by veterinarians and dairymen, "White Scour" and "Lung Disease" have been known to affect calves in this State for a number of years. With the development of the dairying industry they have become more prevalent, and at the present time must be regarded as a common affection of calves in many coastal districts. The mortality varies from 5 to 80 per cent. So persistent and disastrous has it been on some farms as to threaten the extermination of special high-graded herds. One farmer reports that last year he lost thirty out of forty-one calves, while this year he has only been able to rear, by careful nursing, twenty-seven out of thirty-four. Others have lost equally heavily. It is difficult to estimate the annual loss to the State from the prevalence of these diseases, but those best qualified to express an opinion assert that the sum of £10,000 would not be adequate to recompense breeders for their losses.

## "White Scour."

The affection is so termed from its predominant symptom. It is observed in calves from two to ten days old, rarely later, and then only in a sub-acute form. Sometimes the disease is rapidly fatal, the calf dying from two to four days after birth. Frequently the attack is slight, and then, after a more or less lengthy period of intermittent diarrhœa, the calf recovers, to fall a victim in a few weeks to the "lung disease."

*Symptoms.*—The constant sign of infection is the presence of a profuse diarrhœa. The dejections in the early stages are white, with a slight tinge of yellow, and have an unpleasant odour. As the disease advances they become thin and frothy, and contain curds. Shortly before death supervenes a variable quantity of blood may be found mixed with the discharges. The act of scouring is often followed by severe straining, so as to lead to protusion of the mucous membrane of the rectum, which has an inflamed appearance. Associated with the scouring is abdominal pain, manifested by the calf moaning and crying out. Often the affected calf lies continuously on its side, with head turned round resting on the flank, and shows a great disinclination to move. Frequently the animal gnashes the teeth and saliva flows from the mouth. The hair is dry, dull, and ruffled. Its eye dull, and the mucous membrane of the mouth pale.

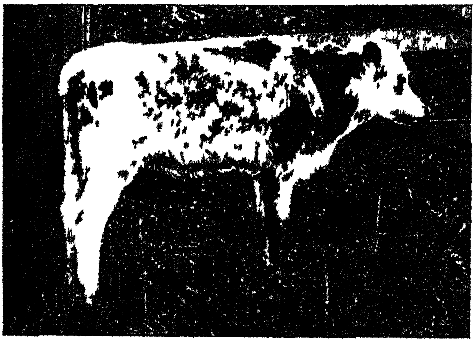


Fig. 1.—Calf affected with modified form of "Lung Disease."

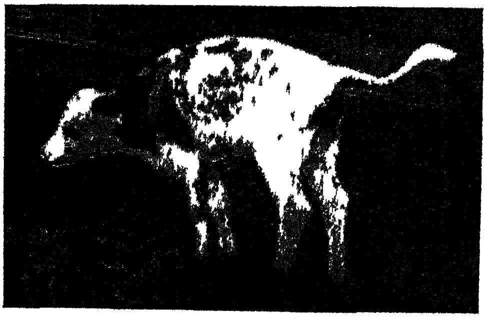


Fig. 2.—Calf suffering mild attack of "White Scour."

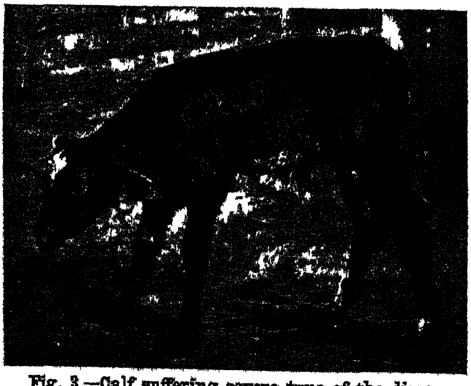


Fig. 3.—Calf suffering severe type of the disease.

In the final stages of the disease the calf becomes extremely weak, so that it is unable to stand without assistance. The eye becomes duller and sinks in its orbit; the flanks tucked up and the abdomen hollow. The nose is dry and hot, and a slight watery discharge flows from the nostrils.

During the acute stage there is high fever — 104° F. to 106° F. — associated with great thirst. In advanced stages the temperature is often below normal. The pulse is weak and rapid. In many acute cases the umbilicus (or navel) is enlarged, its vessels corded and painful when squeezed. Under the scab an excessive amount of purulent matter is often present.

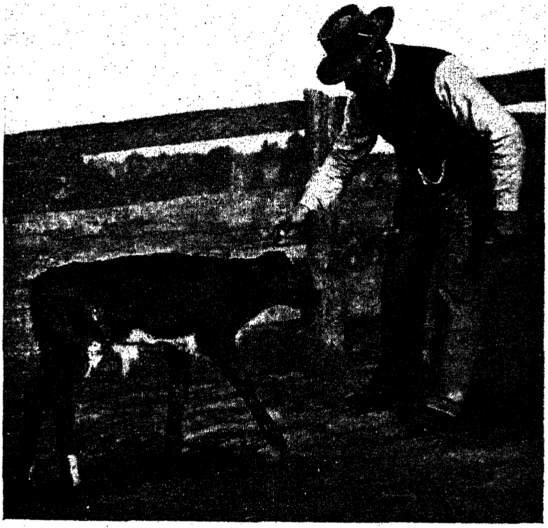


Fig 4.—An advanced case.

Complications.—*Arthritis.*—The presence of arthritis, or inflammation of a joint, has been recorded in connection with "White Scour." The joints most commonly involved are those of the hock and stifle.

*Brain Symptoms.*—Professor Mettam states that brain symptoms are also said to occur as a complication. During my inquiry only one dairyman reported having lost calves with brain troubles—seven had died suddenly in convulsions. Further than the fact that "White Scour" affected some of his calves, we could obtain no definite information.

*Ulceration or Necrosis.*—During his investigations Professor Mettam had the opportunity of seeing upon the farms in Ireland cases of necrosis, involving more especially the soft structures of the mouth.

*Post-mortem Appearance.*—The lesions observed in acute cases of "White Scour," so called, are commonly those of septicæmia and acute infection of the blood.

The degree of emaciation varies according to the duration and virulence of the disease. In acute stages that kill within four days after birth, the carcases may be fairly well nourished. Calves that die after a lingering illness, from the sub-acute form, are, as a rule, much wasted. The umbilicus may be larger than normal, and thickened, while its cord-like vessels can be felt through the skin. Under the scab, over the navel, there may be an abnormal quantity of purulent matter. In some cases there is a certain amount of effusion in the abdominal cavity. Occasionally an exudate of lymph takes place which adheres the intestines to the abdominal wall.

one case the bowels were adherent to the anterior portion of the bladder. The umbilical arteries passing backwards on the inside from the region of the navel to the pelvis may be found thickened, livid in colour, and containing a blood clot. In acute cases the peritoneum shows general congestion, the vessels standing out prominently. Other serous surfaces of the abdominal cavity frequently show minute extravasations of blood. The first three stomachs are usually not affected. The lining of the fourth stomach often shows numerous pin-prick-like hemorrhages. In other cases it may be found to be congested or inflamed, particularly about its pyloric end. The organ in these instances contains huge masses of casein. The intestines are usually congested, and often show sub-mucous hemorrhages. The contents of the bowels are usually watery, white, and frothy, and occasionally there is blood mixed with them. The lymphatic glands within the mesentery are enlarged and softened, and may be hemorrhagic. The colour, size, and consistency of the spleen are, as a rule, found unaltered when the examination is made immediately after death. The liver may be swollen, congested, and slightly jaundiced. The kidneys are usually congested; often they are pale in colour externally, but on section, the inner zone (medulla), is invariably found congested. The lungs of calves that die of "white scour" after a few days' illness may show no departure from normal. Occasionally in these early cases, and almost invariably when the animal has suffered from "white scour" for a period longer than a week, small affected areas are found about the borders of the lungs, and particularly in the anterior lobes. These patches, which are regarded as the initial phase of "lung disease," present a dark appearance, and are firm to the touch (atelectasis). They form a marked contrast with the surrounding healthy, creamy-pink lung tissue. The heart's sac may contain a quantity of straw-coloured fluid (effusion). The heart and pericardium may not appear altered. Occasionally sub-serous extravasations, varying in size from a pin's head to large patches, are seen.

## "Lung Disease."

As previously stated, the investigations of MM. Nocard, Lesage, and Delmer indicate that there is an intimate connection between "white scour" and "lung disease," in that the latter is a sequel to the disease which has "white scour" as its predominant symptom. Many of our dairy farmers who are keen observers have noted that calves that recover from "white scour" subsequently become affected with "lung disease."

*Symptoms.*—The early manifestation of the lung disease may be evident while the calf is affected with white scour, or may not develop until the animal has apparently recovered and is two to four months old. The first sign noticed is dullness, the calf stands with head depressed and ears lopped. There is a tendency to isolate itself from its fellows in some warm sheltered place. The appetite is diminished, the calf comes slowly up to be fed, and after a few swallows appears satisfied. The coat is harsh, dry, and ruffled. The lassitude rapidly increases and fever becomes evident, the nose being harsh and dry. In one case a temperature of 105·6° F. was recorded. The white of the eye acquires a dirty yellowish red colour, and often there is a copious flow of tears. The pulse is rapid and weak. Respiration is hurried and panting, and occasionally the animal emits a dry, painful, suppressed cough. A sticky, glary discharge (muco purulent) flows from the nose and becomes more copious as the disease advances. The calf rapidly experiences great difficulty in breathing, and often rests its head on a rail. Immediately before death the animal lies stretched out on the ground, panting violently, and is cold to the touch. The duration of the symptoms of lung disease varies from three days to three weeks or more. With careful nursing a small percentage of the affected calves recover, but invariably remain weaklings until they are at least two years old.

*Post Mortem Appearances.*—In calves that succumb to lung disease the various lesions described in connection with white scour may be found to persist. In some cases they are very evident and general, in others indications of their pre-existence are only apparent. In advanced cases the changes in the lungs have a resemblance to both broncho-pneumonia and septic hæmorrhagic pneumonia. The lungs are occasionally found to be adherent to the chest wall. The lobules vary from bright to dark red in colour, and are well mapped out by the presence of an inter-lobular effusion. Portions of the lungs are solid to the feel, and on section show numerous small abscesses containing pus-like material. Consequently the disease has occasionally been mistaken by farmers for a form of tuberculosis.

## Remarks.

As the disease affects calves during the first few weeks of their lives, particular attention was paid during my recent inquiry in an extensive dairying district in the South Coast, to the method generally adopted in rearing poddy calves and the conditions which prevail. The following description will no doubt admit of a ready comprehension of the nature of the disease and the aim of the measures recommended for its prevention.

Cows invariably give birth to the calves whilst depastured in extensive paddocks. Within the following forty-eight hours the cow and her calf are brought to the yards. The cow is milked and the calf taken from her and placed in the calf pen. Most of these calf pens have been in use a great number of years, and many are in a dilapidated condition. As a rule they are situated near the dairy, and often not far removed from the yards where pigs are kept. In one case the pigs were found running with the calves. The floors of the pens are mostly earthern, and in many instances are found besmirched with the characteristic dejections of calves severely affected with "white scour." The walls of the shelter-sheds are also often bespattered with the discharges. The pens are seldom or never cleaned out. In these pens the calves are kept for several days until they have acquired the habit of drinking from a bucket. In the meantime symptoms of "white scour" often appear, and one or more calves may die. From the pens the calves are turned into small paddocks, where they are fed from a trough.

For the first few days after they are taken from their mother the calves in some instances are supplied with the mother's milk from a bucket. This good practice is, however, not so generally adopted as it might be, the majority of calves being given separated milk very early in life. In general, separated milk is the diet of poddy calves in butter factory districts, and whey in places where the making of cheese is the chief industry. The wooden cask or iron tank used for collecting the calves' drink is rarely properly cleaned and scalded. In some instances it had not been even rinsed out with water from the day it was first used. One wooden cask we examined was half-filled with milk, over the surface of which mould had grown within a few hours. This milk, we were informed, was for the pigs, but the dairyman intended to refill the cask with milk for the calves without washing it out after being emptied. From the cask the milk is poured into troughs, usually roughly made of hollowed-out log without plug-holes or other provision for cleansing. The wood absorbs the milk and the trough soon becomes contaminated by the dejections of calves falling into it, etc.

*The Cause of the Disease.*—M.M. Nocard, Lesage, and Delmer carrying out separate investigations arrived at identical conclusions that the disease is caused by an ovid bacterium, which penetrates the system of the calf by way of the uncicatrised umbilicus.

M. Nocard promulgated three hypotheses as to when infection takes place, i.e., either infection is of uterine origin; else the cord is infected at the moment of birth, during the passage through the vagina; or else the infection is produced after birth by the newly-ruptured cord coming in contact with foul matter.

To test the first hypothesis he injected a pregnant cow intravenously with a culture of what he regards as the causal microbe, originally collected from a calf that died of the disease. The cow died the following day of hæmorrhagic septicæmia, pure cultures of the microbe being obtained from the blood of the heart, exudations of the pleura and pericardium and pulp of the spleen, while the fœtus was unaffected. He, therefore, subsequently states that it is certain that the umbilical infection whence "white scour" proceeds does not take place in the uterus of the mother.

With regard to the pressure and rubbing the cord undergoes during the passage of the fœtus through the vagina also contributing to infection, it is well known that the vaginal mucous membrane always contains a number and variety of microbes. Although in most cases no statement as to the precise origin of the disease was forthcoming, several farmers have assured me that the disease was introduced into their herds by certain cows coming from infected farms. However, I have not been able to obtain valid evidence of this contention. The possibility of a bull, whose sheath has become contaminated, spreading the disease has not been considered by the investigators mentioned. During my inquiry I met with an instance that appeared to indicate infection in this manner in as much as all the calves of seven heifers served by a certain bull brought from an infected farm had died of "white scour," but after making an inspection of the calf pens and inquiring into the management, the liability of infection from other sources had to be admitted.

That infection is produced after birth by the newly ruptured umbilical cord coming in contact with foul matter, such as the discharges on the floor, can be readily conceived, but that the way of the umbilicus offers the only method of infection one has some difficulty in accepting. The results of some post mortem examinations I made undoubtedly indicated that infection had occurred through the umbilicus; but in many other instances, including cases of severe "white scour," with primary lung lesions, no abnormal condition could be detected in connection with the umbilicus or its vessels. Of these cases the lesions were entirely confined to the fourth stomach and intestines. The stomach was invariably congested or inflamed and contained large masses of casein equal in volume to the size of one's head, while the contents of the bowels were always watery, white, and frothy, sometimes contained curds and occasionally tinged with blood.

The mode of infection in these cases was not visibly through the umbilicus. Was it by way of the mouth? I observed that calves quite commonly suck each others umbilicus, scrotum, tail, and ears—a a habit no doubt induced by sub-acute indigestion following hasty feeding from buckets and troughs. The parts sucked are obviously those which would be readily contaminated with the discharge of "white scour" on the floor of the pens when the animals lie down. Again presuming the causal microbe propagates in the blood-clots contained in the vessels of the umbilicus, a more productive method of infection than that of a calf repeatedly sucking an infected umbilicus could hardly be imagined. This sucking habit is of further interest as suggesting the possibility of contraction in this way of the complication of necrosis of the soft structures of the mouth described by Professor Mettam.

With reference to infection through the respiratory passages, which M.M. Lesage and Delmer admit is possible, as they have successfully infected rabbits experimentally by this channel, and Professor Nocard considers not unreasonable, although he has never been able to verify it experimentally, many of our farmers claim to have had calves four to six weeks old develop lung disease, that had not previously been affected with "white scour." While it is likely that, in many instances, a mild attack of "white scour" had passed unobserved, it is easy to understand that the disease might be contracted by the inhalation of discharges drying on the floors of pens or on the ground and becoming reduced to dust.

As regards the mode of infection, so far as the calves in this State are concerned, I cannot exclude vaginal infection during parturition, but regard subsequent infection from the calf pens as the most common source of the disease. Perhaps in the majority of cases, the infection from these is acquired per umbilicus, but there are other cases which do not seem to be so accounted for, unless, perchance the passage of the virus leaves no local lesion in its track. But on the whole, the habit of sucking contaminated parts, to say nothing of the food troughs and general filth, is at least suggestive of the possibility of infection occurring through the mouth as well as through the nose and by way of the umbilicus.

From what has been stated above it will be seen that sufficient proof has been forthcoming to demonstrate that the disease is of an infectious nature, and that the want of proper care and management in rearing the calves is largely responsible for its propagation. The following measures are therefore recommended for the prevention of the disease and its eradication from infected farms.

## Preventive Measures.

*Care with introduced Stock.*—Many farmers connect the introduction of the disease into their herds with the purchase of stock from infected farms. With calves there is no doubt a great danger, and farmers should exercise great precaution in their purchases, carefully enquiring as to where the calves were reared, and ascertain that they are in good health. Before introducing them into their herds the calves should be kept isolated and closely observed until they are at least three months old. The sheath and tassel of bulls from infected farms should be well washed and disinfected before service.

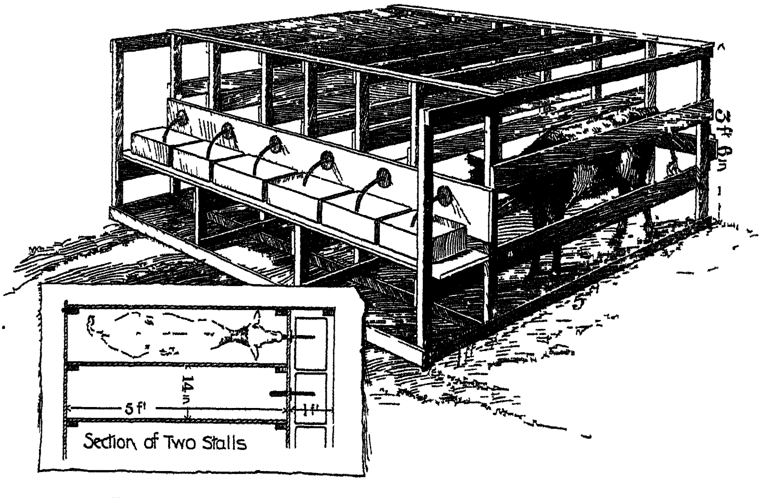


Fig. 5.—Showing arrangement of stalls for feeding calves in.

*Erection of new Calf-pens.*—With farms where the disease prevails the calf-pens must be regarded as the chief source of contamination. Although the existing pens might be made harmless by thorough disinfection, the wisest plan is to erect new pens on a site some distance from those now in use. In their construction entirely new material should be used throughout.

*Washing the Cow.*—When the cow shows signs of being about to calve, the hind parts, including the vulva, anus, escutcheon and tail, should be washed clean with soap and water, and then cleansed with rain-water containing lysol in the proportion of a teaspoonful to a small bucketful of water. The vagina should also be well washed by injecting rain-water containing 2 per cent. of lysol by means of a large syringe.

*Treatment of Calf.*—On the cow being brought up from the paddock to the yards after calving, the calf should be immediately removed, and its umbilicus tied at the part where it naturally sloughs off by a ligature of twine soaked in carbolised oil (5 per cent.). The umbilicus should be then well smeared with carbolised oil and afterwards painted with Stockholm tar of the purest kind. The tar should be again applied when the calves are turned into the paddocks.

*The feeding of Poddy Calves.*—The present practice of collecting milk for calves in wooden casks and feeding from wooden troughs cannot be too strongly condemned. So long as these conditions prevail some derangement of the digestive organs of calves must be expected. Metal receptacles should be used, so that they can be thoroughly cleansed daily by scalding. To prevent the calves drinking too rapidly a number of stalls should be erected, and each calf allowed to drink undisturbed from a separate bucket, as is carried out at the Government Stud Farm, Berry. The system of feeding the calves by means of rubber teats, as adopted at the Government Stud Farm at Wollongbar, approaches nature's method as near as practicable, and aids in the assimilation of food. The general use of a combination of the two systems is strongly recommended. An allowance of the mother's milk materially assists the calf's development and strengthens its constitution. On no account must whey be considered a sufficient food for calves.

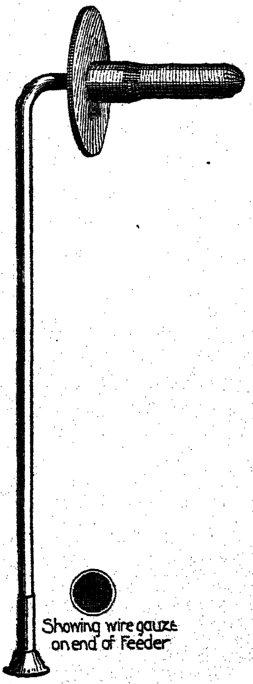

Showing wire gauze on end of Feeder

Fig. 6—Rubber Teat. Clarke's Patent.

*Clean Calf-pens.*—The calf-pens should be swept out daily. The sides of the pens and shelter-shed should be painted with lime-wash, and the floors sprinkled with disinfectant periodically. Calves showing symptoms of the disease should be immediately removed and isolated for treatment or at once slaughtered. Should the disease reappear the pen must be again thoroughly disinfected. Any of the carbolic fluid sheep-dips diluted with water make a suitable disinfectant for the purpose.

*The Calf-paddocks.*—On no account should an affected calf be allowed to run in the calf-paddock. Any calf showing symptoms of the disease should be immediately removed and its dejections either burnt, deeply buried, or disinfected. On farms where the disease exists the necessity of enclosing new paddocks for the calves is strongly advocated.

Literature referred to in the foregoing report :—

"White Scour and Lung Disease in Calves." Professor E. Nocard.

Annales de L'Institut Pasteur, 1901.

"Report on White Scour and Lung Disease in Calves." Professor A. E. Mettam. *The Veterinarian*, July, 1902.

"White Scour in Calves." Journal of Comparative Pathology and Therapeutics. Vol. xv, part 2.

## VITALITY OF PARSNIP SEED.

A CORRESPONDENT writes: "Having experienced difficulty in rearing parsnips from purchased seed, I determined to save some myself.

"The plants were raised in November, 1890, and they seeded about October, 1891. The seed ripened, and was gathered by March, 1902. This seed has been planted lately, and the results, so far as the germination goes, are extraordinary. This is where the trouble begins. A neighbour has told me that these plants will run to seed before next winter, *i.e.*, before purchased seed, because the seed in question was not saved from transplanted plants."

In reply to this, Mr. W. S. Campbell reports :—

The vitality of parsnip seed is but short, and it is always a risk to sow seed more than one year old. Probably the failure was due to use of old seed, and the cause of success with home-grown seed was doubtless due to its freshness.

The parsnip is a biennial, or plant which as a rule flowers and seeds the year after the seed is sown. Occasionally, owing to conditions of season, and perhaps to other circumstances, biennials flower and seed the first year.

It is a practice in some countries to dig up parsnips and store them away for the winter. Towards spring a few of the best roots are selected and planted for seed, more for convenience than anything else; but it by no means follows that seed from such parsnips is superior to that from plants raised in the ordinary way.

# Sheep for the Farmer.

E. D. E. VAN WEENEN ("Lana '),
(In the *Sydney Mail*).

To many it may seem a grim satire to try and teach the farmer or small settler, at a time when flock upon flock are being cruelly decimated, the class of sheep he should go in for. Nor could the writer conscientiously ask him (the farmer) to see in this annihilation an illustration of what type to avoid. The drought has been so relentless in its prolonged sweep of disaster, smiting alike the weak and the strong, that the general principle—survival of the fittest—cannot be always accepted in this discussion. In its fight against nature the hand of man has in many instances been triumphant, but only through foresight and good management. That it has failed in other instances was due, partly through uncontrollable circumstances, partly to negligence, and, at times, inexcusable inactivity. This is not a time for blame, however, but rather a period in which the great difficulties breeders have had to contend with in bad seasons, and their heroic struggles against unforeseen circumstances are most keenly realised. My effort is towards showing the man who has but limited means at command, and who is willing to make the most of his opportunities, how to profit by the misfortunes and errors which are not always easy to remedy. Unlike work in horses and cattle, mistakes in sheepbreeding are the hardest to overcome.

## Principles of Breeding.

In sheepbreeding it is only the rich who can afford to theorise and experiment. Were the experiments always made public the inexperienced would require little further teaching. Unfortunately, perhaps sometimes fortunately, experiments seldom see the light, and when they do they but half teach the inquirer. Practical experience is the surest road to success, but practical experience costs a lot of money and loss of time which the poor man cannot afford. What the latter wants is to be shown a safe road to travel on, and common sense will have to be the guide that will conduct him to the end.

The rules to be adopted in successful sheepbreeding are these:—A thorough study of the soil and climate, and the most reliable methods of handling and disposing of the produce. To do this he must make himself acquainted not only with what can be done with sheep on his own place, but what is being done by his neighbour and by others in the country that are subservient to his interest. These are the main principles for his guidance. A thorough interest in his sheep, which means not only a close insight into their well-doing, but also a study of the requirements of his customers, will be a sure safeguard against mistakes. The farmer who combines agriculture and sheepbreeding has only himself to blame if he cannot make a success of his business, for if he can grow crops with success there is nothing to prevent him being equally successful with sheep-farming; and it has long ago been an accepted principle that the combination of the two pursuits leads to greater profits than if agriculture only is adopted.

In Australia the climate and soils are so varied that every known type of sheep can be successfully bred here, but whilst one or more types may succeed in one district, in another district they may prove partial or wholly failures. This fact is one the small man has to guard against. My description of types will be short, but I will endeavour to make it comprehensive.

## The Merino.

In Australia the Merino holds by far the greatest sway. Its adaptability to almost every climate has been proved for upwards of a century, but it is essentially a denizen of sub-tropical countries, and in them it has been most successful; for it can withstand greater heat than any other type of the ovine family, provided the atmosphere is "dry." It will not thrive in moist air, such as that of the sea coast; in fact, there are few types of sheep that succeed on coastal country. Why this is so has never yet been explained. It cannot be the saliferous nature of the atmosphere there, for the most healthy and strongest constituted sheep are found on the inland saltbush country. The Merino will not withstand extreme degrees of cold. In sicknesses it is also a poor patient. But it has so many sterling qualities that they almost shroud over its disabilities. As a wool-grower, and that of the finest quality, it stands unrivalled. Its meat is among the sweetest and best flavoured, although darker in colour than the other types. For crossing it has no equal, nor has it for hardiness of constitution; and it is also capable of unlimited improvement.

## Not a Farmer's Sheep.

Yet, in spite of all these magnificent qualities, it is not the best farmer's sheep. The Merino is not at its best on rich soil, and the richer the soil the less will it thrive, under natural conditions. There is an exception, and it is to be found in the red soils of Riverina, and in the central districts of this State. But only as long as that country is left in its natural state, for once it becomes cultivated the soil alters, and with it the adaptability of the Merino to that soil also, and for the worst. But by good management this may be turned to greater profit to the farmer, for if he spares part of the cultivated produce for his sheep, and is handy to the fat stock markets, he can make as much again from his flock as he would if it were left to its natural pasture. In this case he must cultivate a sheep that is best adapted for the purpose, a well-shaped and a good-sized animal that does not carry many folds on its skin, yet will grow a good fleece of medium quality. Remember that the heavier you attempt to make the fleece the smaller the success in making a quick fattener of the sheep. A visit to any fat sheep market will easily illustrate this fact. My advice to the farmer is this:—If near metropolitan markets breed for fattening only, and breed either from the Merino crossed with certain British types or from coarse breeds direct. If the expense of sending fat sheep to market is a heavy one, then breed for wool. Buy the best Merinos your pocket can afford, give them the best care and attention, and devote part of your crops to producing the best fleece they can grow. It is money well spent, and will more than repay for the outlay.

## Black-faced Breeds.

I have placed the black-faced breeds before the other British breeds as being the most profitable to the farmer. The black faces in Great Britain are: Southdown, Shropshire Down, Oxfordshire Down, Hampshire Down, and Suffolk Down in England; and the Highland Black-faces (horned) of Scotland. There are other breeds that have mottled or partly-coloured faces, verging from grey to black, such as the Lonk in England, and the Radnor, mountain sheep, and Clun Forest sheep, of Wales; but they are breeds only partly known and not needed in Australia. As regards the first types, three only—the Shropshire, Southdown, and Hampshire—are useful either pure or crossed. For an all-round sheep the Shropshire is by far the best. It is the best cross with the Merino out here, as next to the Merino it will stand the trying climate of the interior. When the frozen meat trade was on a sound basis shippers tried many crosses, and the result of the experiments made for the best lamb suitable for the English market showed that the Shropshire ram crossed with the Merino-Lincoln, Merino-English Leicester, and Merino-Border Leicester found the greatest favour at Home. Since then more successful results have been obtained from the direct cross of the Shropshire and Merino, for the demand in England is now for a fattener of medium weight. In crossing with the Merino ewe the latter should be plain-bodied, yet carrying a good fleece of wool. After three or four lambs have been taken off the ewe the best plan is to fatten the latter and purchase fresh ewes. Where rape or turnips can be grown the lambs can be fattened quickly and with great profit. My advice is: Look well after the ewes, do not let the rams run longer with them than is necessary, do not take more than one lambing a year off the ewes, and attend carefully to their welfare.

On chalk or limestone country the Southdown is a very profitable sheep, and if the country is found suitable to them there is no need of crossing them with any other breed. Both as lambs, yearlings, and two-year-olds they will yield a handsome profit. They make, however, an excellent cross with the Merino. The Southdown, however, will not thrive on overstocked country.

The Hampshire Down sheep is bigger carcased than either the Shropshire or Southdown. In England it is a great favourite on account of its extreme earliness of maturity and the good quality of its meat, derived from the early sheep having been improved by crossing with the Southdown. They will mob together in greater numbers than any of the other English breeds. They are also able to withstand severe climates, and are very hardy. They are not particular as to the food given them. Many vegetable gardeners in England keep flocks of these sheep and fatten them on cabbage stalks, turnip leaves, and unsaleable products of the garden. These sheep cross well with either Lincoln or Leicester. But as a farmer's sheep they rank far below the Shropshire or Southdown.

### White-faced Breeds.

The most suitable of these for Australia are the Lincoln, Border Leicester, Romney Marsh, and English Leicester. The first two have not been tried to the greatest extent in New South Wales; only the Lincoln has kept in favour. Where land is inclined to be marshy the Romneys have been found the most adaptable. All the four types are good of their kind, but as a farmer's sheep I can recommend the Lincoln, and then only for crossing with the Merino, after which the produce should be mated with Shropshire rams. The objection to the large breeds out here is that they require a great deal of attention, especially at lambing time, and should the season prove a droughty one they become an everlasting source of anxiety to the farmer, as they are more prone to knuckle under to adversity than the other breeds I have mentioned. In some places, no doubt, they will do well, and grow to a large size and fatten quickly, but, as I have already mentioned, British trade does not want big sheep. For this reason alone I would advise the farmer to confine his choice to the Merino, Shropshire, and Southdown; and if he cannot make a living with these the sooner he sells out the better.

---

## APRICOT PULP.

IN answer to queries as to the cost of preparing apricot pulp and the commercial value of the product, the Fruit Expert, Mr. W. J. Allen, has furnished the following particulars, which may be of general interest:—

"A ton of apricots would make a ton of pulp; the water used in the process making up for the weight of pits separated from the fruit. In converting apricot pulp into jam there would be a shrinkage of about 15 per cent. The cost of a pulping plant capable of turning out about three tons per day would be about £200, without buildings, which would have to be provided.

At the present selling price of apricot pulp in British markets it would not pay New South Wales growers to export pulp.

In putting up the pulp, barrels could scarcely be used. Tins are invariably used for the purpose, it being necessary to solder the vessels so as to render them perfectly air-tight.

# Diseases in Sheep.

## Strangury (Ulcerated Sheath) in Male Sheep.

W. G. DOWLING,
Inspector of Stock, Forbes.

THIS ailment is generally known amongst flock-owners as "big pizzle," but this is not a good term, because that organ is not the seat of the affection—at least not in its incipient stages—the trouble beginning in the sheath.

This disease, which only affects male sheep—rams and wethers—is becoming much more common of late years, and is a source of much trouble and loss to flock-owners, as many as 20 per cent. of a flock being affected. It makes its appearance at all seasons, though worse in some than others, and commences usually amongst 2-tooth sheep, and from that age up. Lambs are not affected to any extent, but I have noticed it in them also. The disease is contagious in its nature because it can be inoculated, and flies and the like no doubt carry the contagion from one sheep to another. Female sheep are exempt—most probably because the tail acts as a protector from flies—and rams will not work when affected.

In the first stage of the disease the sheath becomes ulcerated on the outside, and if left alone the affection spreads inside, working its way right up to the penis, and eventually blocks up the passage so that the sheep cannot urinate. It is a common sight to see them with their back arched, straining, only a small quantity of urine coming away, and that in drops, hence the term "strangury," which I have applied to it, and which for the purpose of enabling stock-owners to recognise the condition, is as good as any other (not being a veterinarian I am not clothing it in its proper term).

Once this ailment becomes chronic—which it does if left alone (and in my experience it never cures itself)—it is expensive and tedious to get rid of, so here is a case in which "a stitch in time saves nine," and taken in its earlier stages it is easily cured, or practically so. There appears to be no particular time in the year for it to make its appearance, and in some years it is just as virulent when there is no grass or grass-seeds as when there is, and, as I have before mentioned, it commences on the outside of the sheath around the edge of the orifice, and spreads inwards.

Many owners do not take any trouble in the matter of treatment, merely drafting the affected sheep out of the flock when a sale is made, because a buyer, if he knows his business, always rejects them, as they are unthrifty and spoil the look of a good flock.

So little notice being taken of it is the cause of its spreading. In its first stages, unless a sheep is turned up, it cannot be detected, but it only takes a few days to develop, and, to an experienced eye, it is easily detected by the gait of the animals as they walk along—they walk wide behind and crutchy, with the head as a rule carried low; in fact, they are constantly trying to make urine. *Post mortem* discloses only localised lesions of a ball case; the bladder is inflamed and so is the penis; the other parts of the body are normal.

As to prevention, only a little of practical value can be said under this head, because the cause is not known, and as far as I am aware there is never any effort made to discover one. Now that sheep are more valuable, stock-owners may become more observant and try and find its history, and my chief object in writing this paper is with the view of arousing interest in such an important matter, and as all ailments have a beginning, it is well to be in time, because what is now, comparatively speaking, a "small potato" may develop if unchecked into a very large one, and require stringent measures to prevent its spreading. It occurs in all the States where sheep are kept, and is not endemic. Now to return to prevention. Assuming the disease to be contagious, and I think there is no doubt that it is in some form or another, the first course is take out all the affected ones, if wethers or rams, and put them in a hospital paddock prior to treatment if thought desirable, which in all cases it should be, both from a humanitarian and a business point of view; and whenever a flock of male sheep are in a yard for counting or other ordinary work they should be carefully looked over and all suspected ones taken out.

Now as to treatment and method. This is the chief point: It must be cheap, and at the same time effective and not require too often using. When they are to be dressed the best place is the wool-shed, because you have the contagion all in once place, and not all over the run. The method of operating: If a wether sheep is the patient, if a bad case, the sheath must be opened up and all the ulceration taken away, then washed with a weak solution of corrosive-sublimate (or sheep-dip is used at times, but is not as good as the former). This only requires one, or at most two, dressings to heal up, not, of course, in its former state, but it relieves the animals, and they fatten as well as normal animals; if a patient is not very bad an ordinary syringe can be effectively used, and the sheath well washed out with a weak solution of corrosive-sublimate. This requires to be done for two or three times at intervals of seven days or so, but is effective as far as a cure is concerned. It is the only way to treat rams that are to be used in the flocks. If opened up the prepuce would be deformed, and prevent the animal from performing his functions properly, and dirt would get where it is not required. The shed, after operations of this nature, should be washed out with antiseptic each time it is used as a matter of precaution and cleanliness. No sheep should be turned back into the flock until cured.

REFERRING to the contribution by me on "Anthracoid," or septic poisoning of sheep at shearing, I would strongly recommend where *stud sheep* are being shorn that immediately the wool is removed they should be sponged all over with a weak solution of corrosive-sublimate; they must not be dipped because there would be a risk of their swallowing some, and death would result.

A small zinc bath could be placed in a pen and big enough for the sheep to stand in, and a sponge used to saturate every part.

The corrosive-sublimate must be mixed by a competent person, so that there would be no mistake, say, 5 gallons, diluted with as many gallons of water; this would be sufficient for most stud flocks, and would be cheaper than using the corrosive-sublimate in tabloids, and only touching the cuts, as there would be no risk of any part containing contagium being missed. It would not hurt the wool mixed at the same strength as the tabloids, one of which dissolved in 4 oz. of water equals one in a thousand. This, together with my other recommendations would very much, I am sure, mitigate the risk from this dangerous affection.

## FODDER PLANTS.

It is a pleasure to read an article like the one that appeared in the last month's *Gazette* from Mr. Macdonald on the natural fodder trees of this State. It is easy to see that the writer has practical knowledge on the matter. I am sure that any person with practical experience will agree with Mr. Macdonald that the Kurrajong is one of the most valuable fodder trees we have, and it grows over such a large extent of country. Many of the other trees that Mr. Guthrie mentions, in his previous article, as being of such a high nutrient value are not to be compared to the Kurrajong. For instance, the Rose-wood and Gum-trees are simply of no value whatever for stock fodder, as stock will not eat them, even when starving.

The Box will keep sheep alive. They prefer the leaves from the old trees best; but if fed too long they become very indigestible, and form into hard balls in the sheep's stomach. On the salt-bush plains the Wilga is a very good fodder tree, but anywhere off the salt-bush country it is of no value; large stock will not eat it, and it is a difficult matter to get sheep to touch it. In the New England district the Apple-tree is the most valuable fodder tree, sheep being very fond of it in a dry time. And I think that what the stock like and eat well, proves beyond a doubt that it must be the best. Of course I do not doubt Mr. Guthrie's analysis, but at the same time would like to know how it is that some of these trees that show such a high nutrient value are disliked by stock, and if eaten become almost indigestible. I have seen both cattle and sheep feed on almost nothing else but Kurrajong and rock-salt for months, and they were in good health and condition all through.—BUSH NATIVE.

# Woolly Aphis, or American Blight.

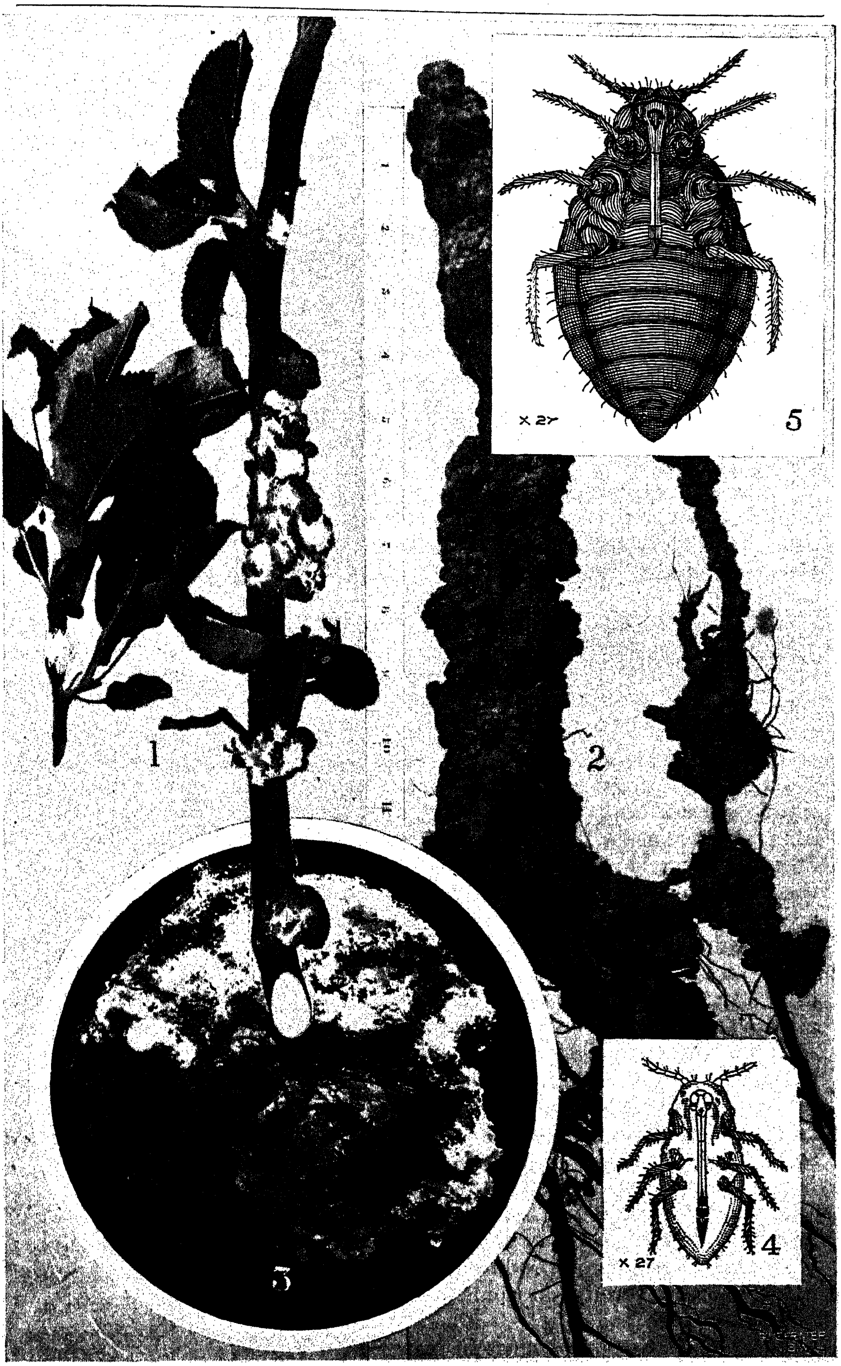
(*Schizoneura lanigera*, Hausman).

WALTER W. FROGGATT.

THIS familiar apple pest is well-known under both the above popular names, though several American entomologists have protested against their country being credited with being its native home, and claim that the word "American Blight" is a misleading name, as it was known in Europe long before it was noticed in America. It was first recorded from Europe in 1787, and in the early part of the following century spread over France, Germany, and Belgium. Fitch states that nurseryman informed him, in 1848, that it was very prevalent in Virginia and Pennsylvania, where thousands of trees had been destroyed by this pest. It appears, at any rate, to have been introduced into England by way of America, for Sir Joseph Banks traced it, in 1789, to a London nursery, whose owner had imported apple-trees from America, but it is not improbable that it was previously taken to America from Europe, and imported into England *via* that country. The original home of many of our commonest garden and orchard pests becomes a matter of conjecture as soon as their food plants become articles of commerce, and, at the present time, "Woolly Aphis" is found in nearly all the countries where apples are cultivated.

This aphis attacks apple-trees in two different ways, first upon the roots, and secondly upon the trunks and branchlets, and our experience is that any trees having the roots infested will soon show signs of the pest upon the upper portion of the stem, and in early summer one can watch them crawling up the trunks from the roots in regular droves. It has been claimed by a number of writers that the root-infesting aphis is a distinct species from that found upon the branches; Buckton has described an allied species under the name of *Schizoneura fodiens* found upon the roots of black currant bushes. Theobald states that in all cases where he has examined woolly aphis, taken from the roots of apple trees in English orchards, he found them to be Buckton's species (*S. fodiens*), and not the true woolly aphis of the trunk (*S. lanigera*). In reviewing French's "Handbook," in the second volume of this Gazette (1891), Olliff says: "but it were, perhaps, hardly necessary to allude to the long-forgotten error, that the root-form and branch and trunk-form, of woolly aphis are distinct species, in terms that imply that the question has required investigation by our local observers for its settlement. For many years it has been as well-established a fact that these two forms are only phases of the same insect, as that the leaf and root-form of the dreaded vine-pest phylloxera are specifically identical."

The practical application of producing blight-resisting apple stocks is due to the experiments of Messrs. T. Lang & Co., the well-known



WOOLLY APHIS ON APPLE-TREE.

**1. Affected twigs. 2. Roots showing galls caused by woolly aphis. 3. Portion of root infested with active aphis. 4. Larva of woolly aphis. 5. Mature female.**

Victorian nurserymen, in 1868–70, who used a variety known as the "Majetin," their attention having been drawn to this stock by a note in Lindley's "Guide to the Orchard." They also introduced the "Northern Spy" from America, and proved them to be perfectly immune to the attacks of this insect. And these facts are so well-established that now, instead of the old haphazard methods of using any kind of apple stock, all other varieties of apples are grafted upon these and other blight-proof stocks. It is, therefore, only a question of good cultivation and time, when all the old-infested apple orchards have run out, that woolly aphis will die out in Australia, for, unlike America and Europe, we have no species of wild crab apples growing in our scrubs or forests that can prolong its existence. When varieties of apples susceptible to woolly aphis, but grafted on blight-proof stocks are planted in an orchard where there are other apple-trees growing that are infested with the aphis, either upon the roots or branches, though they are powerless on the blight-proof roots, they will soon find a lodgment above the graft, particularly if the bark gets broken or scarred, and when once established will commence to breed and form cankers, which will, if neglected, soon swell out into unsightly knots. But, in a modern up-to-date apple orchard, properly looked after, away from old-infested orchards, there will be no woolly aphis to render the trees unsightly, and diminish the crop.

The production of these root and branch galls or excrescences is caused by the irritation to the plant tissue by the many sharp, lance-like beaks of the aphides piercing the bark, and, while sucking up the sap, promoting an excessive flow to the injured spot, which forms a spongy growth that is continually increasing in size while the aphides are alive; but destroy the insects, and it is wonderful how quickly the injured places heal over, and the galls disappear as the tree thrives. Many writers state that the woolly aphis only infest an injured spot on the bark, and as long as there are no scars or cuts from pruning there is no foothold for the pest; but this is not correct, for where they are plentiful they will cluster round a leaf-bud and insert their beaks into the bark and form regular ridges along the tender branchlets.

In old trees grafted upon stocks that are not blight-proof, the base of the trunk—where it comes in contact with the earth—the main, and all the smaller radiating rootlets are covered with nodules, or much more gall-like excrescences, growing together, so that a root no thicker than one's finger is often swollen out into great masses. It is somewhat remarkable that although no doubt some trees do die clean out from the attacks of this aphis, other trees may be infested for many years, and, through neglect, become gnarled and knotted both above and below ground into most fantastic forms, yet they will manage to exist and bear fruit for a number of years. Trees aborted after this fashion may be met with in many old orchards and gardens all over the State; of course they do not produce a decent crop of fruit of marketable value when gathered, and would be much better dug out to make room for a good tree.

In aphis-infested orchards in New South Wales, the pest begins to show upon the trees towards the end of summer, and as the leaves fall off, and the winter rains set in, it soon spreads all over the trees, the festoons of white wool hanging in little tufts all along the branches, but though it shows most about this time, live aphides can be found in an infested orchard all the year round. They cannot withstand excessive heat or hot winds, and in the dry western country I have seen them lying in little heaps scorched up and dead beneath the trees after a real "hot-wind" day. Towards the end of summer, ladybirds, chiefly (*Leis conformis*), and several small *Rhizobii*, as well as lace-wings and other enemies, do a great deal in reducing their numbers; but in the absence of the severe winters, which check their propagation for some months in Europe and America, these aphides, like other pests, can breed all the year round in our sunny climate.

## America.

Writing of this pest in America, Harris says: "The eggs of this louse are so small as not to be distinguished without a microscope, and are enveloped in a cotton-like substance, furnished by the body of the insect. They are deposited on the crotches of the branches, and in the chinks of the bark at or near the surface of the ground, especially if there are suckers springing from the same place. The young, when first hatched, are covered with a very short and fine down, and appear in the spring of the year like little specks of mould on the trees. As the season advances, and the insect increases in size, its downy coat becomes more distinct and grows in length daily. This down is very easily removed, adheres to the fingers when it is touched, and seems to issue from all the pores of the abdomen. When fully grown, the insects of the first brood are $\frac{1}{10}$ of an inch in length, and when the down is rubbed off, the head, antennæ, suckers, and skin are found to be of a blackish colour, and the abdomen horn yellow. The young are produced alive during the summer, are buried in masses of the down, and derive their nourishment from the sap of the bark and the alburnum of the young wood immediately under the bark."

When this description was penned, in 1841, the winged forms of *Schizoneura lanigera* had not been discovered, but in 1856 Dr. Asa Fitch described the winged generations, which consist of male and female insects, appearing towards the end of the cycle of generations.

## Europe.

Several eminent entomologists have studied the life-history in Europe, of which the following is a brief outline. The wingless (apterous) female. called by some writers the "queen or mother aphid," winters in a crevice in the bark of the apple-tree, covered with a little woolly secretion. In the spring she gives birth to small pale reddish lice, which, as they increase in size, become clothed with a mass of long spiral woolly threads or filaments, which form a protective covering; they produce living larvæ in turn, among which, Theobald says, "occasionally winged females are produced, but they are unusual. In colour they are chocolate-brown, and have the venation peculiar to the *Schizoneura*, and distinctive from other species of the group. The winged viviparous (producing live larvæ) female appears from July to September, and in time gives birth to oviparous (egg-producing) females and males, neither of which have any rostrum or mouth, so their lease of life is short, but long enough to fertilise the egg-laying females, which, before dying, deposit a single egg on the bark of the tree, which gives birth to the queen aphis, which, though a virgin female, after hibernating produces living larvæ at the advent of spring which carry on the next generation.

## Australia.

Observations were commenced early in May, when a number of infested trees in an orchard near Gosford were put under treatment with various remedies, the results of which are given in detail later on.

At this time of the year the Woolly Aphis were well developed, little colonies, consisting of full-grown wingless females, with numbers of larvæ beneath them, or crawling about among the enveloping wool above them. This brood appears to agree with what Buckton calls pupæ, but, as they are constantly giving birth to living larvæ, are really wingless viviparous females. They were clustered in every cavity on the bark, attached to it by their lance-like beaks, with their legs hanging down free, or resting against the back of their nearest neighbour, but they never rested their legs against the bark; the beak seems quite strong enough to support the body when once they have pierced the bark.

The woolly filaments above formed a regular coat over them, while most of the adults had a globule of liquid attached to the tip of the abdomen, with other fallen globules that had dropped from them entangled and resting among the woolly threads. Under a low power microscope the birth of the larvæ could be easily followed; it is enveloped in a thin transparent skin, that, as the head and thorax are extruded, splits and works down over the body, freeing the antennæ and legs, which are previously folded down the sides, and the whole operation may be completed under fifteen minutes.

The new-born larva has semi-transparent legs and antennæ, with black eyes, and a bright yellow body; the general form is elongate oval, with the head slightly rounded in front, and the beak or rostrum, which is folded down between the legs, reaches to or beyond the tip of the abdomen. The larvæ do not appear to settle down at once, but wander about among the adult aphides in a very aimless manner for some time.

*Adult Wingless Female.*—General colour slate blue, with a greyish tint, caused by the dust of the woolly secretion, and appears to be an ochreous yellow when dropped into oil of cloves. The apical half of the upper surface of the abdomen is ornamented with numbers of fine white spiral filaments that, curling round, are capable of hiding the whole of the insect. The head is rounded in front, sloping down on either side; the antennæ six jointed, first and second joints short and stout, third very long, fourth and fifth shorter, sixth much shorter, and attenuated at the tip to a finger-like process. The eyes stand out on the side of the head, and the tubular mouth, swelling out into a lanceolate tip, reaches to the base of the hind legs when resting beneath the body; the thoracic portion, to which the long slender legs are attached, is merged into the abdomen, which, oval in form, is broadest in the centre. With a slightly raised boss on either side of the back, surrounded with a brown ring (which represents the long cylindrical nectaries or honey-dew glands upon the bodies of the other groups of aphides), the extreme tip of the abdomen terminating in a rounded knob, clothed with fine hairs.

*Winged form.*—These consist of adults of both sexes of a general dark, dusky brown colour, with large, slightly smoky wings, rounded at the tips, the sexes differing very little from each other except in the structure of the abdominal segments. They have no mouth, small eyes, and short antennæ, their life being very short, and devoted to the production of the winter eggs. In this State they generally appear about midsummer, just after the New Year, but as the wingless aphides will be found in the crevices of the cankers on the branches all the year round in our summer climate, they evidently do not rely upon the winged forms for carrying on the generations, as is the case in a more severe climate.

## Treatment of Infested Trees.

Early in May last five large apple trees, badly infested both upon the roots and above ground, and just losing their foliage, were taken under observation in an orchard near Gosford.

In the first place, the earth was cleared away for a distance of 2 feet round the trunk, and the main roots laid bare. Three lb. of waste tobacco (dry leaf) was weighed out, and after the galls had been scraped and cut off the main roots, and all the smaller damaged and aborted roots cut clean out, this was spread over the exposed roots and round the trunk level with the surface of the ground, and the earth then filled in, a bucket of water poured in at the trunk, and the ground left undisturbed for three months. When these trees were again opened out, both the trunk below the surface and all the roots were perfectly healthy, in spite of the rough treatment, and no signs of aphis could be found, the nicotine soaking into the bark and coming in contact with the soft-bodied aphides, had destroyed them completely.

This is a simple and cheap remedy for the root aphis, and has the advantage that the residue of the tobacco acts as a manure after destroying the insects. The bisulphide of carbon treatment recommended by some writers is not only too expensive for the ordinary orchardist, but there is always the danger of damaging the roots if the liquid is injected too close to them.

Fumigation was also carried out with other trees under the usual conditions, and on the removal of the tent all the clustering aphides were found dead, hanging up by their beaks, but when the trees were carefully examined three weeks later, here and there in the large crevices a few small live aphides were discovered. So I came to the conclusion that fumigation would have to be carried out twice to perfectly clean the trees, if the treatment is tried at the reason when the females contain fully developed larvæ, a few of which are born from the moribund fumigated aphides after the fumes are dissipated.

Spraying with resin-wash or kerosene emulsion will soon check and reduce woolly aphis when once the root-infesting colonies are removed, so that the scars formed by them grow out of the bark, but the fact that this aphis does not actually kill the trees leads the amateur or neglectful orchardist to leave it alone until the pest gets ahead of him. As pointed out, no person forming an orchard at the present day who goes to a reputable nurseryman for his trees should introduce or infect his place with this pest; but the unfortunate thing is that so many buy infested trees from dealers, at auction sales, or from neighbours who do not know any better than themselves.

If when planting young fruit trees, the grower would only take the trouble to dip the roots of each tree in a soda or soap wash and clean them thoroughly before planting, he would destroy many tiny little creatures, as well as aphis, that are so easily introduced with the stocks, and so difficult to stamp out when once they get the run of the place.

When, however, as is so often the case, a man buys an orchard in "full bearing," as the newspaper advertisements so charmingly put it, he frequently finds he has secured a very fine crop of pests which take a lot of fighting, and woolly aphis is one of the commonest.

## LIST OF PAPERS DEALING WITH WOOLLY APHIS (*SCHIZONEURA LANIGERA*), CONSULTED.

**Atkinson, C. S.**

"Woolly or American Blight" (*Schizoneura lanigera*, Haus.) Indian Museum Notes. Vol. IV, p. 52, 1891–3.

A general account of the pest given ; a record of its occurrence in India ; with a very good list of papers and authors on this insect.

**Audouin, I. V.**

*Observations sur alteration qui produit Puceron lanigère. Annals Soc. Ent. de la France.* A. IV, Bull, p. ix, 1833.

**Buckton, C. B.**

*Monograph of the British Aphides.* Vol. III, pp. 81–110, 1881. This portion of the work deals with this group of the aphides where five species are described and figured.

**Bolt, F.**

*Memoires sur le Puceron lanigère et sur les moyens de la detruire*, Caen, 1831.

**Comstock, J. H.**

Report of the Department of Agriculture, U. S. America, p. 258, 1879.

**Crawford, F. S.**

Report on the Fusicladums, Codlin Moth, and other Fungus, and Insect Pests attacking apple and pear trees in South Australia, 1886.

The American Blight or Woolly Aphis, p. 41.

A general account of its prevalence in South Australia.

**Fitch, Asa.**

First and Second Report on the noxious, beneficial, and other insects of the State of New York, 1856 pp. 7 and 50.

The author was entomologist to the New York State Agricultural Society, and gives a lot of valuable information about this pest.

**French, C.**

Report on Injurious Insects of Victoria, 1891.

The Woolly Aphis or American Blight. Chap. VI, p. 35, pl. 1.

This is an interesting account of the introduction and spread of this pest in Victoria, and deals with the question of blight proof stock.

**Harris, T. W.**

A Treatise on some of the Insects injurious to Vegetation. Ed. by C. L. Flint,n. ed., 1890, p. 243.

The first edition of this fine work was published in 1841, where a wood-cut and interesting description of woolly aphis is given.

**Hausmann, I. F.**

*Beitrage zu den materialien fur eine kunstige bearbeitung der guttung der Blattlause.*

Illiger's Magazine, *Insckt* 1, 1802, p. 426.

The original description of the species is given.

**Lichtenstien, J.**

*Migrations of Plant Lice.*

*Entomologist's Monthly Magazine.* XV, p. 134, 166, 1878; and XX, p. 79, 1883.

**Osborn, Herbert.**

The Identity of Schizoneura panicola, Thom. and Schizoneura corni, Fab.

*Insect Life.* Vol. II, p. 108, 1889-90.

**Ormerod, E. A.**

A Text Book of Agricultural Entomology, 1892, p. 183.

A general account of this aphis is given with a wood-cut and remedies.

**Riley, C. V.**

First Annual Report of the Noxious, Beneficial, and other insects of the State of Missouri, p. 118, 1869.

The Apple-rot Plant Louse, Eriosoma (pemphigus) pyri, Fitch. He says it has been known to exist for as least twenty years. Wood-cuts and general account of pest.

**Saunders, W.**

Insects injurious to Fruit Trees, 1889.

Insects injuring the apple No. 1. The Apple-root plant Louse. He gives a description and wood-cut of the species and its galls, and says it was first recorded as a pest in America in Downing's Horticulturist, 1848, at which time thousands of young trees were found so badly infested that they had to be destroyed.

**Theobald, F. V.**

American Blight or Woolly Aphis (*S. lanigera*) and a related subterranean species (*S. fodiens.*)

Report South Eastern Agricultural College Wye, Kent.

**Thomas, C.**

Eighth Report of the State Entomologist of Illinois, p. 126, 1879. *The Aphidæ of the United States*, and an enlargement of the author's paper in the Trans. Ill. Hort. Society, 1877.

**Tryon, H.**

Report on Insect and Fungus Pests, 1889.

Queensland Department of Agriculture, Chap. II, p. 36.

An account of its ravages in the Toowoomba District, and a resume of its life history and reputed remedies.

# Effect of Engine-boiler Steam on the Vitality of Seeds and Spores.

N. A. COBB.

Among the various subjects of experiment mentioned at the Rust in Wheat Conference, "to give some indication of the vast extent of the experimental work which members of the Conference have conducted during the period that has elapsed since the first Conference adjourned," No. 20 is as follows:—"*The practicability of disinfecting and cleansing threshing machinery by means of live steam.*"

The experiments referred to had been conducted by the writer during the then current year, and were suggested by the injury done to grain by immersion in hot water of more than 200° Fahrenheit, and by the use of steam in disinfecting many articles such as milk-cans.

The object of the experiments was to ascertain, if possible, whether, in view of the wide use of steam-engines for driving threshing-machines, winnowing-machines, and other agricultural machines, it would not be feasible to use steam from the engine boiler to kill the germs of plant diseases that collect in threshing-machines and other places, and also to kill the seeds of weeds that collect in a similar manner.

It was first ascertained that an immersion of the seeds of wheat, oats, barley, and a number of other grains in *water of 200° F.* or thereabouts for a few minutes destroyed the germinating power. Many agricultural machines, however, being constructed partly of iron and partly of wood, will not stand repeated applications of hot water without being seriously injured. This fact led up to the supposition that steam, though even hotter than water, and for that reason as well as others a better disinfectant, would be far less injurious to such machines.

## Effect of Steam on Vitality of Wheat-grains.

The first experiment with steam gave very promising results, seeds and spores being readily killed by it in a few seconds. The question then became, "For what length of time, and in what manner, should the steam be applied in order to make it a practical agent for the disinfection of agricultural machinery?"

Ten samples of wheat were subjected to the action of steam for one, two, three, four, five, ten, fifteen, and twenty seconds respectively. The steam was issuing from the cock connected with the water-guage of a common portable farm-engine, and the grains were held about 1 inch from the orifice of the cock, and were steamed on one side only, namely the back, where the embryo lies nearest the surface. On being planted, the seeds germinated as follows:—

| No. of seconds steaming. | Percentage of germination. | Plants. |
|---|---|---|
| One | 95 per cent. | Fair. |
| Two | 60 per cent. | Poor to fair. |
| Three | 20 per cent. | Poor. |
| Four | 40 per cent. | Poor. |
| Five | None. | |
| Ten | None. | |
| Fifteen | None. | |
| Twenty | None. | |

From this it became evident that under the conditions of the experiment the action of steam for five seconds is sufficient to kill grains of wheat.

## Effect of Steam on Bunt Spores.

July 24th, 1896, I took nine Bryant and May's wax vesta boxes and removed the top and knocked out the bottom. I took an equal number of pairs of inch and a half squares of mill-board, as shown in Fig. 1, and proceeded to infect grain of 275-grade Allora Spring wheat as follows:—About one hundred balls of bunt were broken up by a first assistant, and from the mass of spores thus obtained, this assistant infected each of the square pieces of mill-board equally, so that each pair appeared as in Fig. 1. The pairs were marked as follows—blank, 1, 2, 3, 4, 5, 10, 15, and 20. The "blank" pair was placed at the ends of the cylinder made from a match box, sixty grains of wheat having been placed inside the cylinder. I handled the squares, and a second assistant the boxes, so as to avoid the transference of the spores. Taking one square, I held it horizontal with

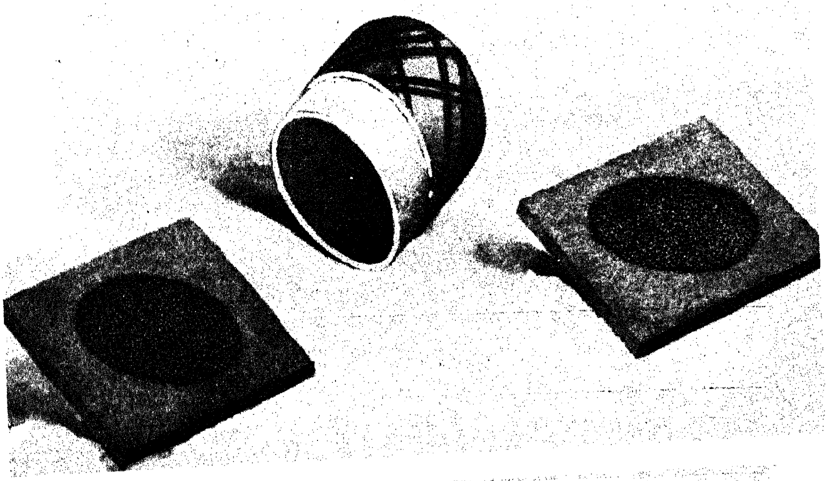


Fig. 1.—Matchbox with bottom removed, and the two squares of strawboard stained with the spores of bunt, as described in the text.

the cylinder, so as to form a temporary box. The second assistant put in the sixty grains, I placed the other square on, and gripping the whole affair as shown in Fig. 2, shook it methodically for two minutes. The grains were then placed in a sterilised dish, and planted by a third assistant with sterilised forceps. Pairs of squares—1, 2, 3, 4, 5, 10, 15, and 20, each carrying bunt spores as shown—were steamed at the engine by me, one, two, three, four, five, ten, fifteen, and twenty seconds respectively, and then sixty grains of wheat were shaken against them exactly as described for the blank or check experiment, in which no steaming of the bunt spores took place. The lots of grain were planted in rows marked Allora Spring blank, A.S. steam 1, A.S. steam 2, A.S. steam 3, A.S. steam 4, A.S. steam 5, A.S. steam 10, A.S. steam 15, A.S. steam 20. Each row was given Sugar Company's B manure at the rate of 7s. worth per acre. The resulting growth was as follows:—

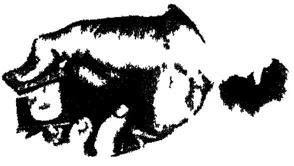


**Fig. 2.—Showing method of subjecting wheat-grains to the influence of bunt spores, as described in the text.** The two squares of strawboard are used as a temporary top and bottom to the box, which is shaken with the grains of wheat inside. This method imitates in some degree the manner in which wheat would become infected in a threshing machine after it had been used to thresh a bunted crop of wheat.

## Effect of Steam on Bunted Surfaces.

| Bunted surface steamed for. | Date sown. | Date examined. | No. plants sown. | No. plants that grew. | No. plants that were bunted | Variety |
|---|---|---|---|---|---|---|
| 0 seconds ... | 7 July .. | Dec. | 52 | 45 | 36 | Allora Spring. |
| 1 ,, .. | 7 ,, .. | ,, ... | 52 | 52 | 4 | ,, ,, |
| 2 ,, ... | 7 ,, . | ,, .. | 52 | 48 | 10 | ,, ,, |
| 3 ,, .. | 7 ,, . | ,, . | 52 | 50 | 4 | ,, ,, |
| 4 ,, ... | 7 ,, ... | ,, . | 52 | 47 | 2 | ,, ,, |
| 5 ,, ... | 7 ,, ... | ,, .. | 52 | 49 | 4 | ,, ,, |
| 10 ,, .. | 7 ,, ... | ,, ... | 52 | 50 | 5 | ,, ,, |
| 15 ,, .. | 7 ,, .. | ,, .. | 52 | 51 | 4 | ,, ,, |
| 20 ,, .. | 7 ,, .. | ,, ... | 52 | 51 | 2 | ,, ,, |

Allora Spring was used in these tests as being a variety that it is easy to infest with bunt in the manner attempted—that is to say, by bringing its grains into contact with surfaces to which it is known that living bunt spores are attached.

From the circumstances surrounding the experiment, I am inclined to think that one or two plants in each row might have been bunted from other sources than those noted in the above description. It is certain that most of the crops of this variety growing that year in the vicinity were bunted from unknown sources. The seed used for these experiments was derived from the same source as that of the crops mentioned.

The table shows that when the bunted surface was not steamed at all, the seeds were so thoroughly infected that about 10 per cent. were killed outright—*i.e.*, did not produce plants that came above the ground so as to be examined. Of those that did grow, 75 per cent. were bunted. The severity of the disease was greatest in this row, regardless of the number of cases.

Steaming the bunted surfaces, for no matter how short a time, was very effective in reducing the amount of disease, and a steaming of one to three seconds was about as effective as steaming for a longer time.

From this it seems fair to draw the conclusion that a surface that can be exposed to the action of live steam, having a temperature of 212° Fahrenheit, can be disinfected from bunt in a few seconds by such action.

I am inclined to think the surfaces used in this experiment were more likely to furnish secure lodgment for the spores of bunt than most of the surfaces to be found in farm machinery—say, for instance, in a threshing machine.

The fact that some spores appear to have escaped the treatment points to the probability that spores in cracks and crevices of machines would escape the destructive action of steam. This leads to a suggestion which may be arrived at from other directions, namely, that *cracks and crevices in such machinery should be absent, as far as this is possible.* No doubt manufacturers of these machines keep this fact in mind, but it is probable that there is much *room for improvement* in this direction without very much increase in the cost of the machinery.

It is a well-proved fact that bunt spores are killed by exposure for fifteen minutes to water at a temperature of 140°. The interior of small spaces that can be closed in—such spaces as exist in many farm machines—can be raised to and maintained at this temperature by means of steam.

With an abundance of steam a scalding temperature can be maintained. Such a procedure would be a highly effective method of disinfecting farm machines and of killing any obnoxious seeds they may contain, if such seeds are no more resistant to steam than are grains of wheat.

Steam applied in this manner would penetrate crevices and cracks, and would be more effective than if applied for a few seconds from a steam hose.

The application of steam in the manner suggested involves the use of a flexible jacketed hose capable of resisting the pressure of steam from the boiler where the latter is generated. Such hose is manufactured for conducting steam.

# Condensed Milk.

M. A. O'CALLAGHAN.

CONDENSED milk might be defined as new milk reduced by evaporation in a vacuum-pan to about one-third of its original volume. It should contain all the ingredients of new milk, and, strictly speaking, should be free from all foreign matter save cane sugar, which latter is added to facilitate preservation. Before the theory of germ life was understood, and, consequently, before we knew how to sterilise milk by means of heat, it was impossible to get condensed milk without the addition of cane sugar. Mr. S. Borden (an American) first solved the problem of condensing and preserving milk, for which he took out a patent in 1856. He first tried preserving it without the addition of sugar, but abandoned the process when he found the milk would keep sweet but a couple of weeks, and adopted the method of adding sugar, and putting the product up in air-tight tins, with which the world is now familiar. Europeans were not far behind, and the Swiss soon became masters of the problem also, and in 1866 a factory was erected by the Anglo-Swiss Condensed Milk Company. This factory still exists, and has, in addition, many branches in other European countries. One of the properties of condensed milk is that, when properly made, it will keep indefinitely. Various attempts have been made to manufacture condensed milk in Australia, but most of them have been unsuccessful, owing to the inability of the manufacturers to produce a milk with the desired keeping properties. Those acquainted with European conditions and climate will readily understand that the successful manufacture of condensed milk in this country will be very much more difficult than in Europe or America. To successfully manufacture condensed milk without the aid of chemical preservatives means that the milk shall be in the hands of the manufacturer before fermentation has made any apparent development. This is not an easy matter in a climate so moist and warm as that of New South Wales. Unless considerable care and cleanliness be observed milk will go sour two or three hours after being milked during our warm summer mornings. This means that the farmers who produce the milk must, immediately it is milked, take steps to check the progress of bacterial fermentation. This is easily successful in countries where cold water is always procurable, but it is another matter where the coldest water on the farm is not below 70 F. Heat and cold are the only legitimate methods for preserving milk intended for human food. Cold is not, as has been pointed out, easily procurable by the New South Wales farmers, and the only resource left is heat. If all farmers thoroughly understood the process of pasteurisation it would be possible but expensive to get them to preserve the milk intended for condensation by means of pasteurising; but it does not seem probable that this will be feasible within the near future, so the would-be manufacturer of condensed milk must limit himself as far as each factory is concerned to a small sphere. He must draw his milk from farmers living so close to his factory as will enable them to deliver it within, say, an hour after milking has been completed. This means that our condensing factories must be small, and hence the cost of manufacture will be high. Central collecting stations for cooling or pasteurising the milk might be erected at convenient centres, and the milk after treatment despatched to the central factory for condensation, but this will also materially increase the cost of manufacture.

## The necessity for pure Drinking Water for Cattle.

Experienced dairy farmers in all countries and in all times have laid particular emphasis on the necessity of pure drinking water for dairy cows. From two points of view science has demonstrated the wisdom which experience has taught. Analyses on a large scale have shown that a cow's milk on the average contains 87 gallons of water in every 100 gallons of milk yielded. The water required to supply this demand on the animal's system, as well as the water required for other bodily functions, the cow must obtain from the food and water supplied to her. In fact, a cow of fair size in full milk giving, say, 4 gallons of milk per day in summer requires to drink from 7 to 9 gallons of water to satisfy her daily desires in that direction. Running streams are ideal watering-places for dairy cattle. Such water is almost always pure and cool, but, unfortunately for Australian dairying, very few of our dairy districts are thus favoured by nature. Waterholes are more common than running streams. The water in these ponds gets contaminated by reason of the droppings from the cattle; putrefactive bacteria develop therein, the water becomes tainted, not alone because of the taste imparted to it by the presence of the manure, but also because of the taste and smell given to the water by the bacterial products formed from the organic matter during the weeks in summer when the water is so warm as to be favourable to bacterial activity. Such water taints milk in the same manner as turnip-tops and other food taints milk by the flavouring matter passing through the cow's system to the milk. Another fruitful source of taint by such water is as follows:—The cows walk in the waterholes, and the water is frequently above the cows' bellies; the organic matter in the bottom gets stirred up, and the organisms accompanying such matter get deposited on the cows hair and skin, where they remain until milking time, when the shaking of the skin due to milking causes the now dried matter, and with it the bacteria, to fall into the milk-pail, where in turn they set up their injurious fermentations and cause undesirable flavours. Such milk is not easily preserved, and hence is not favourable to the manufacture of a high-class condensed milk. Thus it is that this water question is an important one for the proprietors of condensing factories to consider. If, instead of allowing the cattle access to these waterholes or ponds, the water was pumped therefrom into troughs, a great improvement would result. It would pay farmers to do this, because they would get more milk. A cow will not drink freely of bad water; she only uses enough to slack her thirst, and as a result the milk yield suffers. A cheap windmill would give power enough to pump the water from these ponds into troughs, and the ponds could then be preserved from the access of cattle by a wire fence. It is not too much to expect that farmers will do this for the service of an industry of profit to so many.

## The Mysteries of Condensing Milk.

So secretive are the managers of most condensed milk factories that, in the minds of the general public, there is an air of mystery surrounding the entire handling and manufacture of condensed milk. This air of mystery has been unusually great in this country because of so many failures to turn out a reliable product regularly. Some extraordinary reasons have been given as the causes of these failures. One told to me was that there was a microbe common to the pastures on which the cattle that produced the milk were fed, that this microbe passed through the cow's system to the milk, that it withstood extremely high temperatures, and finally that it grew in the milk about three months after manufacture, causing the milk to go bad. Needless to say this was the creation of a mind untutored in the ways and means of the microbes of fermentation. Microbes were certainly found in the finished product, but they gained access thereto after the milk had left the vacuum-pan where the condensation took place. Another story of failure was that the site chosen for the factory was too high above sea-level to get sufficient vacuum. The site, I understand, was chosen by the man who gave this excuse. From what I have written it will be understood that the failures have been mainly due to the fact that those placed in charge had little or no experience of an industry that requires a considerable amount of knowledge and training. If this knowledge has to be bought at the expense of the man who finds the capital, the work becomes expensive. It is an easy matter to have £5,000 or £10,000 worth of milk stored away, all of which might go bad a month after being made. There is really no mystery attending the manufacture of condensed milk. Like brewing, the would-be manufacturer must know his business. An ordinary worker from a condensed milk factory in Europe or America will not do to take charge of a condensing business in Australia. The man who would successfully make condensed milk in this State, without the aid of drugs, must have a good knowledge of fermentation as well as a practical knowledge of his work. Strictly speaking, in a large business every batch of milk made should be examined bacteriologically soon after manufacture. This would enable the manufacturer to detect very early whether there was likely to be any fermentation, and the milk might then be sold for immediate use; or re-processed to destroy the cause of the fermentation.

## Preservatives in Condensed Milk.

If chemical preservatives were allowed in the manufacture of condensed milk, the problem would be very easily solved, because the most difficult part, viz., the preservation of the milk, would be ensured. However, many countries forbid the use of chemical preservatives, and I am of opinion they should not be allowed in milk which is put up in sealed tins or vessels, even though a statement to the effect that the milk does contain preservatives be put on the label.

# Seed Wheat:

## AN INVESTIGATION AND DISCUSSION OF THE RELATIVE VALUE AS SEED OF LARGE PLUMP AND SMALL SHRIVELLED GRAINS.*

BY N. A. COBB.

### Introduction.

ALL the remedies we devise for the alleviation of crop diseases are but so many acknowledgments of the existence of disease.

Our greatest hope is for the production of disease-resistant varieties. These will be resistant through certain constitutional characteristics.

Next in importance to such constitutional characteristics is the maintenance throughout the life of the plant of vigorous growth. This involves health and strength from the very start. The seed must be good, and the seedling strong, if the best results are to be secured.

Manifestly one of the main elements in the production of a strong seedling is a strong sound seed. In all annual crops, such as wheat, this question of strong sound seed is an ever recurring one, and one that requires careful attention. Nevertheless, it is frequently neglected. It is so much neglected that I am of the opinion that the losses caused by the diseases from which such crops suffer would be very materially lessened if we could bring the average of our seed up to the point actually found profitable by, say, the best fourth of our farmers.

The following pages present the results of an inquiry into the state of our seed wheat, with the object of defining the extent to which it is practicable to add to the vitality of our wheat crops through more careful attention to the seed.

The quality of our seed wheat is looked at here only in the light of a single test, namely, the relative amount of small and shrivelled seed and useless or deleterious matter to be found in the sample tested. Needless to say a better test would have given more

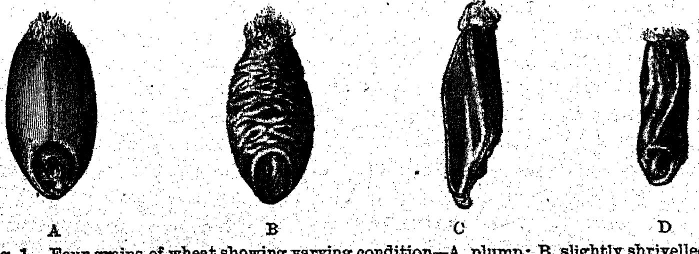


Fig. 1.—Four grains of wheat showing varying condition—A, plump; B, slightly shrivelled; C, shrivelled; D, much shrivelled; enlarged four diameters.

---

* This investigation was suggested by the Interstate Wheat-rust Conference. Two related investigations are reported in the published proceedings of the Conference. The present report differs from previous ones in being the result of several years' field work on an extended scale, with the object of arriving at average figures that might be made the basis of definite rules for practice.

valuable results. The test applied has the merit of having a proved relation* to the amount of the resulting crop, as well as that of being easily applied.

I cannot help feeling that a number of people will, at first glance, regard any effort to prove the lower value of small grains as seed to be rather in the nature of an effort to kill a dead horse. Still I find it impossible to disclaim the necessity of harping on this subject so long as there exist among us advocates of the use of such seed, and, above all, so long as it can be shown that our practice is as far below what it ought to be as it is at present.

So long as it can be shown in the manner here adopted that the bulk of our wheat growers are using seed of a quality no higher than that disclosed by these examinations, there will exist the disagreeable necessity on the part of our leading lights to keep on pointing out the fact. It seems to me that our agricultural officers of all kinds, and especially the teachers in the agricultural schools, should keep the facts of the case prominently before growers and intending growers.

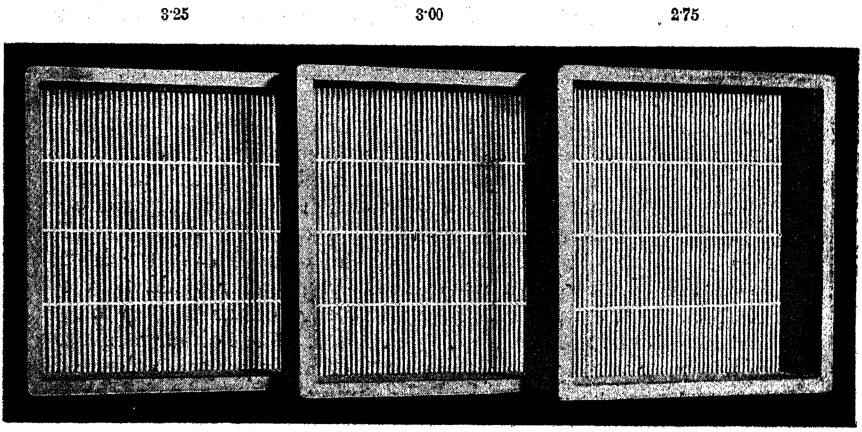


Fig. 2.—Three sieves with meshes of three different widths, from 3·25 millimetres to 2·75 millimetres; shown about one-tenth natural size.

This can be done at the schools and colleges through passages in lectures, and even more forcibly by ocular demonstration year by year through the growth side by side of plants derived from small, medium-sized, and large seed. Object lessons of this kind have an exceedingly high value if used in the right way—far higher than is generally realised. Both students and visitors will, from such continuous annual demonstrations, be more strongly impressed than through almost any other means.

For several years demonstration plots of this nature were grown at the Wagga Farm, and they were inspected, first and last, by thousands of people. Side by side were to be seen rows of plants grown from large, medium-sized, and small grains. In each season these were to be seen growing on varying soil, and exemplified in the most diverse varieties of wheat. They were indeed eloquent and convincing, though silent, arguments against the use of anything but large and plump seed.

---

* The proof is presented in the second part of this article.

To this day growers of a conservative type have not ceased to tell me that these little demonstration plots were the means of opening their eyes to the fact that the extra number of seeds in a bushel of pinched wheat was not all that had to be taken into consideration in connection with the comparison of large and small grain for seed purposes, and that further trials have convinced them of the advisability of using the large grains for seed.

This is not to be wondered at, for no one could fail to see, if he examined the demonstration plots with care, that the plants from large and plump seed were not only larger but healthier and more resistant to all adverse conditions. They suffered less from disease if disease appeared, and they more readily surmounted the difficulties placed in their way by bad patches of soil or by scanty rainfall.

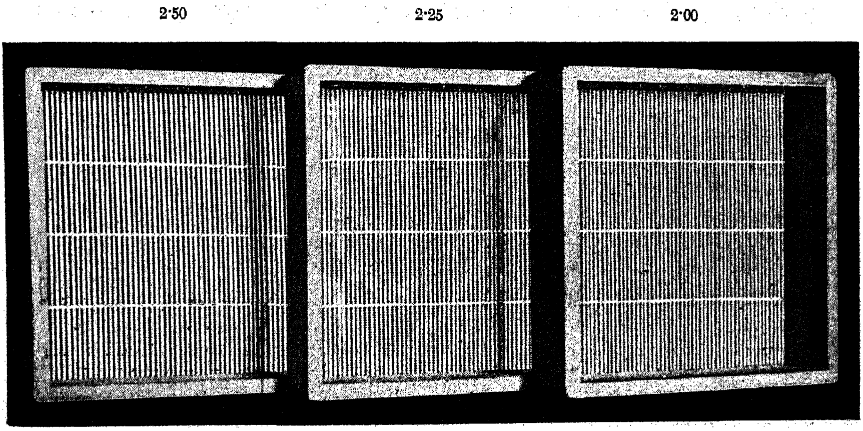


Fig. 3.—Three sieves of varying mesh from 2·50 millimetres to 2·00 millimetres; shown about one-tenth natural size.

Figures 2 and 3 show the kind of sieves used in testing the quality of seed-wheat for this report. The sieves are made from "half-round" brass wire, placed with the flat side down. They were specially made with accuracy.

Rev. E. E. Hale, consoling with one too sensitive about unfavourable comments in the public prints, remarked that of all the people who saw the print not half would see the item in question; and of those who saw it, half would not read it; and of the half that read it, half would not understand it; and of the half that understood it, half would forget; and that under such a haphazard process the ones that remembered probably would not amount to much any way.

It is some such thought as this that leads me to emphasise the advisability of demonstration plots at our colleges and farms and wherever else we can present them. I fear that experts are terribly prone to over-estimate the number of people that read their lucubrations, and if these be sifted according to Dr. Hale's keen-witted method it will be seen that our printed teachings stand in need of all the reinforcement possible.

## 1.—Our Seed Wheat.

The differences in yield arising from the use of seeds of different sizes,* and the consequent gain to farmers through the proper grading of seed wheat so as to secure for seed only that which is best, led to a desire to ascertain the precise quality of the seed wheat being used in this State. Accordingly arrangements were made for collecting samples in various parts of the State at sowing time, the samples to be as far as possible the ones actually being sown.

The task of collecting these samples was entrusted to Mr E. D. Butler, and it was carried out carefully and systematically—several hundred samples being collected, to each of which was attached a statement showing the locality in which it was being sown, by whom it was being sown, and the name of the variety. Each sample consisted of about five pounds of grain, though in some cases there was somewhat less, and in a few cases more.

These samples were graded in the same manner as the samples that were used as the basis of the article entitled "The Grading of Wheat," published in the *Agricultural Gazette*, Vol. VIII, p. 855, that is to say the December number, 1897. The same sieves were again used, and the sizes of the grain were the same as then secured, and similar illustrations were again prepared as the result of these siftings. It is, therefore, sufficient to allude to the methods then used; and to reproduce here some of the illustrations prepared in explanation of that article. *See* Figs. 2, 3, and 4 to 10. I was careful to use as far as possible the same methods as before, in particular because it was from similar gradings that various sized seeds were obtained for the experiments made to ascertain precisely what are the relative yields from large and small seed growing under similar conditions for a series of years; experiments whose results are presented in the second part of this article.

3·25 3·00 2·75 2·50 2·25 2·00 Tailings.

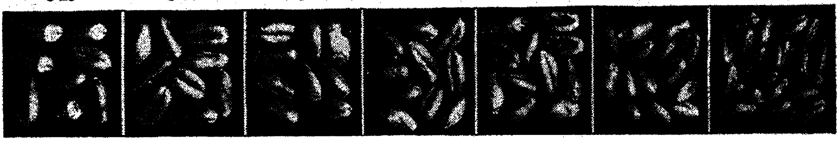


Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9. Fig. 10.

**Figures showing the actual size of the grains belonging to each grade yielded by the sieves shown in Figures 2 and 3. The proper grade numbers are placed above each illustration.**

An attempt is made in the above illustrations to show the sizes of the grains that result from the grading done with the sieves shown in Figures 2 and 3, but these illustrations are somewhat deceptive because of the nature of the wheat grain. If the reader will examine a shrivelled grain, such as is figured at C, D, Fig. 1, he will at once remark the fact that its outline is large in proportion to its actual weight. This is owing to the shape and structure of the wheat grain, a shape that prevents it from being so placed with reference to the observer that its contour will adequately represent the loss of substance due to shrivelling. The actual differences in size are also obscured by the assemblage of the grains. If the reader will bear these facts in mind in looking at the above seven illustrations, he will derive a more correct impression. Grains of these seven sizes are also shown in Figs. 14, 20, 21 and 22. The actual variation in the size of the grains derived from a single ear of wheat is well and accurately illustrated in the woodcut, Fig. 11, which was prepared with great care to illustrate this point.

Of course the sizes of the meshes here used in the sieving are purely arbitrary, but they are the result of considerable study of the question of the range of variation in the grain of wheat, and, in the absence of any recognised standard, have served the purpose of the present and other investigations.

### *Method of Examination.*

After the samples collected by Mr. Butler were graded, the weight of each of the seven resulting grades was taken, and, with a calculating machine, reduced to its percentage of the whole sample from which it was taken. Each sample, therefore, gave a result like the following:—

| % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % T | Mixture. | Contamination. |
|---|---|---|---|---|---|---|---|---|
| 1·1 | 7·6 | 20·7 | 23·4 | 35·6 | 5·5 | 5·9 | Slightly mixed .... | Oats and white-heads. |

---

* See the second part of this report.

by which is meant that 1·1 % of the sample was composed of grains of the size shown in Fig. 4, 7·6 % of the sample was composed of grains of the size shown in Fig. 5, and so on down through the seven grades. Thus, the series of seven figures gives a kind of picture of the sample. Looking at the first of the seven figures, we can see at once what proportion of the grains are large; looking at the other end of the series, we can see at once what proportion of the grains are small.

The sample on being compared with first-class samples of the same variety could be classed as good, bad, or medium; and it is needless to say that this classification was the main object of the examination. The results enable us to pass judgment with some certainty on the quality of the seed being used, and to discuss on a sounder basis than heretofore the question whether we are using seed as good as we ought to use, and, if not, what amount of money farmers could afford to expend in grading with a certainty of increasing the profits of wheat-growing.

In 1898, at the instance of the Hon. Sydney Smith, the then Minister for Agriculture in this State, the late Mr. Thompson collected data as to the proportion of the various varieties of wheat in actual use in the State. The record of his results, which appears in the Annual Report of this Department for 1899, shows that the varieties then in favour were as follows, and in the following order:—First, Steinwedel, Purple Straw, and Allora Spring; second, White Lammas and Australian Talavera.

Mr. Thompson had unequalled opportunities for collecting this information, travelling, as he was, among the farmers in all parts of the State as lecturer on agricultural subjects, and the information should be very reliable.

It is interesting to note that the samples gathered for the purposes of the present inquiry give as the favourite varieties the following, and in the following order:—Purple Straw, 52%; White Lammas, 27%; Steinwedel, 14%; Red Wheat, 3%; Golden Drop, 2%; Blount's Lambrigg, 1%; Velvet, 1%.

From this it will be seen that, at the time of collecting these samples, 93% of the wheat being sown consisted of Purple Straw, Lammas, and Steinwedel, with a large preponderance of Purple Straw.

Now the farmers must use these varieties either because they prefer them or because they can get no others, unless, indeed, they give the matter no thought, and simply sow whatever comes handy. I think we may unhesitatingly dismiss this latter contingency from the discussion, as experience shows that farmers have decided opinions, and are no more likely than others to neglect to think about the means they employ to make a living.

Of the remaining two alternatives, namely, whether they use these varieties because they prefer them, or because they can get no others, it seems to me we must choose the former. Other sorts are available, and at prices within the reach of all. If a farmer does not use some other variety, it is not because he cannot get it, nor because he cannot afford it. This seems to me the inevitable conclusion.

It seems equally clear that the farmers must prefer these varieties because they consider them to be the most profitable ones to grow.

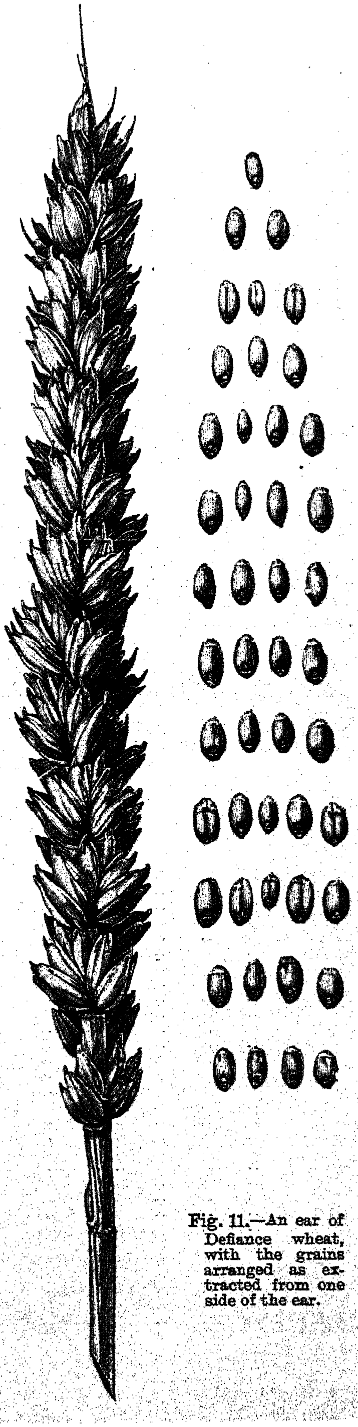


**Fig. 11.**—An ear of Defiance wheat, with the grains arranged as extracted from one side of the ear.

Against this opinion on the part of farmers, we must place that of the numerous experts and specialists in this country, among them the writer, that these varieties are not absolutely the best wheats.

No name was known for 6·5 per cent. of the samples collected. To this figure may be added the number that were submitted under wrong names, and though there is no evidence to show precisely what this latter number is, there can be no doubt that it reaches a considerable magnitude. I consider it to be quite safe to say that the samples unnamed or incorrectly named would constitute 20 per cent. of all the samples collected. This evidence that 20 per cent. of our farmers are sowing "wheat" shows that we have yet a great deal to do in spreading elementary knowledge concerning one of our most important agricultural industries.

The samples that were manifestly mixed or slightly mixed constitute 45 per cent. of the whole number collected. This mixture of different varieties in our seed wheat is a serious obstacle to progress. How will it ever be possible to judge of the relative merits of varieties under such conditions? If we have no means, or imperfect means, of judging the relative value of varieties, how are we to make satisfactory progress in the introduction of better varieties?

The percentage of bunted samples was seven. This shows that the various methods of combating this, the second most important of our wheat diseases, are probably made use of widely and with good effect. There is no reason why, if farmers would systematically make use of the means now at their command, this disease should not be practically eradicated. The production of seed wheat by the methods advocated by the officers of the Department and practised at the experiment farms, together with the use of the various fungicidal treatments that experience has shown to be efficient would practically annihilate this disease in the State in five years time.

The best samples were handed in under the names White Lammas and Steinwedel. This is in accord with the results of the three years' tests formerly made on the principal varieties grown in the State, both these varieties standing high in that series of tests. Incidentally, this gives corroboration to the names under which the samples were handed in, and is one of several points that have given me sufficient confidence in the nomenclature of these samples to base certain reasoning upon it.

## SAMPLES OF NEW SOUTH WALES SEED WHEAT, GRADED TO SHOW QUALITY, 1897-8.

NOTE.—The higher the figures in the left-hand columns the better the sample.

| Locality. | Variety. | Remarks. | | | 3·25 | 3·00 | 2·75 | 2·50 | 2·25 | 2·00 | Tailings. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Canowindra | P. St. | ............ | | | 3·8 | 24·6 | 23·1 | 37·3 | 8·5 | 1·1 | 1·1 |
| Nyngan | " | Mixed | | | 17·4 | 41·7 | 31·3 | 8·7 | ·3 | ·1 | ·4 |
| Near Dubbo | " | Mixed | Oats | | 10·0 | 22·4 | 33·7 | 29·7 | 3·7 | ·1 | ·3 |
| Dubbo | " | Mixed | | | 6·9 | 24·8 | 32·2 | 27·0 | 7·2 | ·9 | ·3 |
| Near Dubbo | " | Mixed | Oats | Split | 9·2 | 25·6 | 27·5 | 23·8 | 10·4 | 2·1 | 1·1 |
| Dubbo | " | Mixed | Oats | | 12·6 | 28·7 | 27·4 | 21·9 | 1·1 | 1·1 | 1·1 |
| " | " | ............ | | | 15·3 | 35·5 | 25·7 | 15·5 | 6·0 | 1·6 | ·9 |
| Geurie | Stuw. | Mixed | Oats | | 13·3 | 33·0 | 28·8 | 17·5 | 5·3 | 1·0 | 1·3 |
| Narramine | " | ............ | | | 6·7 | 26·5 | 26·3 | 26·0 | 12·1 | 1·8 | ·1 |
| Near Dubbo | " | Mixed | | | 5·6 | 26·0 | 33·2 | 27·1 | 4·8 | ·7 | ·3 |
| Near Wellington | " | ............ | | | 8·6 | 14·7 | 25·0 | 33·1 | 12·1 | 3·7 | 2·1 |
| Wellington | P. St. | ............ | | | 7·9 | 31·8 | 28·8 | 20·7 | 7·3 | 1·8 | 1·5 |
| " | " | Mixed | Oats | Bunt | 15·5 | 14·7 | 27·2 | 32·3 | 5·9 | 1·5 | 3·0 |
| " | " | .. | Oats | Bunt | 5·2 | 24·0 | 28·1 | 31·0 | 8·3 | 2·1 | 1·3 |
| Near Wellington | " | Mixed | Oats | Bunt | 4·7 | 28·5 | 28·7 | 25·4 | 9·4 | 2·1 | 1·3 |
| Wellington | " | Mixed | Oats | Bunt | 6·5 | 26·8 | 28·2 | 24·8 | 10·0 | 2·2 | 1·4 |
| " | " | Mixed | Oats | Bunt | 1·3 | 10·4 | 27·2 | 34·3 | 20·9 | 4·6 | 1·4 |
| " | " | Mixed | Oats | | 6·2 | 19·8 | 25·2 | 33·2 | 11·6 | 2·6 | 1·1 |
| " | " | Mixed | Oats | Bunt | 2·3 | 13·6 | 24·8 | 40·5 | 15·4 | 2·5 | 1·1 |
| " | " | .. | Oats | Bunt | 5·0 | 24·7 | 30·1 | 28·6 | 8·2 | 2·1 | 1·3 |
| " | " | Mixed | Oats | | 2·0 | 14·9 | 22·5 | 38·3 | 18·1 | 2·9 | 1·3 |
| " | " | Mixed | Oats | Bunt | 6·2 | 23·1 | 25·5 | 30·8 | 10·1 | 3·0 | 1·4 |
| " | Wh. T. | ............ | | | 3·0 | 18·3 | 23·1 | 33·7 | 17·9 | 3·3 | ·7 |
| " | " | Mixed | Oats | | 6·9 | 23·7 | 28·8 | 24·2 | 9·5 | 3·0 | 3·8 |
| " | " | Mixed | Oats | | 8·3 | 26·8 | 32·2 | 21·0 | 7·4 | 1·6 | 2·7 |
| " | " | ............ | | | 5·3 | 12·9 | 24·0 | 43·3 | 11·7 | 1·6 | 1·2 |
| Near Wellington | Wh. L. | ............ | | | 3·4 | 14·4 | 25·2 | 30·0 | 14·4 | 2·4 | 1·2 |
| Wellington | Stnw. | .. | Oats | | 8·6 | 34·5 | 18·2 | 16·2 | 9·7 | 3·1 | 9·5 |
| Lincoln | " | Mixed | Oats | | 9·3 | 29·7 | 28·6 | 20·4 | 9·4 | 1·4 | 1·4 |
| Mitchell's Creek | P. St. | Mixed | Oats | | 20·6 | 12·2 | 24·4 | 28·7 | 10·7 | 1·6 | 1·8 |
| Lincoln | " | Mixed | | | 11·7 | 27·9 | 31·4 | 20·3 | 4·4 | ·9 | 3·6 |
| Maryvale | " | ............ | | | ·6 | 4·5 | 13·2 | 34·7 | 31·0 | 11·0 | 5·0 |
| " | Wh. T. | Mixed | Oats | | 8·2 | 27·7 | 31·5 | 22·0 | 6·6 | 1·5 | 2·6 |

SAMPLES of New South Wales Seed Wheat, Graded to show Quality, 1897-8—*continued*.

| Locality. | Variety. | Remarks. | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|---|---|
| Maryvale | Wh. T. | Mixed Oats | 3·7 | 9·5 | 25·2 | 41·8 | 18·6 | ·6 | ·7 |
| Deniliquin | P. St. | ............ | 7·4 | 19·4 | 22·3 | 28·9 | 15·5 | 4·6 | 1·7 |
| " | " | ............ | 2·0 | 11·9 | 21·2 | 33·2 | 25·2 | 5·2 | 1·7 |
| Finley | " | Mixed | 1·8 | 13·6 | 31·0 | 36·2 | 12·2 | 1·9 | 3·2 |
| " | " | Mixed | 2·3 | 10·6 | 22·3 | 40·6 | 16·1 | 5·7 | 2·3 |
| " | " | Mixed | 3·5 | 20·3 | 33·1 | 34·6 | 7·0 | ·8 | ·8 |
| " | " | ............ | 3·9 | 15·5 | 26·4 | 39·0 | 12·9 | 1·6 | ·6 |
| " | " | Mixed .. .. Bunt | 12·9 | 29·7 | 35·0 | 19·8 | 2·6 | ·1 | ·1 |
| Jerilderie | " | ............ | 23·0 | 43·5 | 20·9 | 9·1 | 2·8 | ·4 | ·4 |
| " | " | .. Oats | 3·2 | 15·8 | 25·8 | 31·6 | 14·6 | 4·6 | 4·4 |
| Berrigan | P. St. | Mixed | 2·8 | 19·1 | 33·0 | 36·5 | 7·8 | ·8 | ·4 |
| " | " | Mixed | 6·5 | 29·8 | 29·3 | 29·8 | 3·8 | ·5 | ·2 |
| Argoon | .... | ............ | 2·0 | 16·0 | 34·7 | 39·5 | 7·3 | ·2 | ·1 |
| Coolamon | R. St. | ............ | .. | 4 0 | 18·0 | 36·1 | 34·0 | 6·2 | 1·7 |
| Banksdale | " | ............ | ·9 | 7·5 | 26·8 | 40·0 | 22·2 | 2·2 | ·5 |
| Wagga Wagga | P. St. | .. Oats | 3·1 | 15·6 | 30·5 | 33·4 | 15·2 | 1·4 | ·7 |
| Coolamon | R. St. | Mixed | 1·8 | 10·0 | 28·2 | 41·1 | 16·4 | 2·2 | ·7 |
| Fairfield (Coolamon) | P. St. | ............ | ·8 | 4·5 | 14·6 | 41·0 | 31·0 | 7·3 | ·8 |
| Coolamon | " | Oats Smut | 1·9 | 10·3 | 24·6 | 31·7 | 14·1 | 2·8 | 14·7 |
| " | " | ............ | 1·4 | 8·6 | 21·6 | 40·2 | 21·8 | 3·2 | 3·2 |
| " | " | ............ | 2·9 | 18·4 | 31·8 | 32·7 | 10·2 | 1·5 | 2·3 |
| " | " | Mixed | ·6 | 6·7 | 14·6 | 35·8 | 35·3 | 5·9 | 1·2 |
| " | " | Mixed Oats | 2·4 | 15·2 | 27·2 | 36·4 | 15·2 | 2·7 | 1·1 |
| Currawana | " | ............ | 3·6 | 15·4 | 32·3 | 37·5 | 9·4 | 1·5 | ·4 |
| Coolamon | " | Mixed Oats | 3·2 | 15·9 | 25·0 | 40·2 | 12·7 | 1·9 | 1·3 |
| North Berry Jerry | " | Mixed | 2·0 | 20·0 | 37·0 | 38 0 | 2·3 | ·4 | ·4 |
| Coolamon | R. St. | ............ | 3·8 | 15·3 | 29·1 | 40·6 | 9·8 | 1·0 | ·4 |
| " | R. Tu. | Mixed | ·6 | 13·3 | 21·9 | 40·3 | 21·8 | 1·4 | ·6 |
| " | R. Wh. | ............ | 2·0 | 8·7 | 16·9 | 44·8 | 26·1 | 1·8 | ·7 |
| " | Stnw | ............ | 2·2 | 17·3 | 24·1 | 35·5 | 16·1 | 3·6 | 1·3 |
| " | " | ............ | 7·0 | 32·8 | 32·3 | 16·0 | 9·8 | 1·3 | ·7 |
| Berry Jerry | " | ............ | 6·6 | 22·3 | 30·3 | 26·2 | 11·6 | 2·2 | 1·2 |
| Ganmain | P. St. | ............ | 2·1 | 16·8 | 34·3 | 35·6 | 9·2 | 1·3 | ·7 |
| " | " | ............ | 3·0 | 20·6 | 35·6 | 33·3 | 5·6 | ·7 | 1·2 |
| " | Stnw | Mixed | 6·4 | 22·4 | 27·1 | 26·9 | 13·9 | 2·4 | ·9 |
| " | " | ............ | 2·3 | 19·7 | 30·1 | 30·6 | 13·1 | 2·8 | 1·5 |
| Old Junee | Bl. L. | ............ | 1·0 | 2·9 | 6·3 | 39·5 | 41·2 | 6·7 | 2·4 |
| " | Wh. H. | ............ | 8·8 | 18·8 | 32·8 | 35·9 | 3·5 | ·1 | ·1 |
| " | R. St. | ............ | 2·9 | 14·1 | 30·1 | 36·0 | 14·6 | 1·8 | ·5 |
| Junee | Rt. T. | Mixed | 3·5 | 8·8 | 29·9 | 44·0 | 12·2 | 1·7 | .. |
| Cootamundra | Stnw | ............ | 12·9 | 32·5 | 25·4 | 19·6 | 6·9 | 1·4 | 1·4 |
| " | P. St. | .. Oats Bunt | 2·3 | 13·9 | 19·3 | 32·0 | 21·8 | 5·7 | 4·9 |
| " | " | Mixed Oats | 5·1 | 15·7 | 27·3 | 32·8 | 14·2 | 2·2 | 2·7 |
| " | " | ............ | 2·4 | 6·3 | 25·3 | 36·7 | 22·6 | 3·2 | 3·5 |
| Temora | " | .. Oats | 3·2 | 15·1 | 20·7 | 36·5 | 16·1 | 3·7 | 4·9 |
| " | " | ............ | 6·4 | 30·7 | 34·4 | 20·5 | 6·1 | 1·1 | ·8 |
| Near Temora | " | .. Oats | 3·9 | 17·2 | 27·5 | 36·3 | 13·2 | 1·4 | ·5 |
| Temora | " | Mixed | 3·1 | 19·0 | 26·7 | 37·2 | 11·4 | 1·5 | 1·1 |
| " | " | Mixed Oats | 2·2 | 15·7 | 27·5 | 35·2 | 13·6 | 2·4 | 3·1 |
| " | " | Mixed | 4·1 | 15·4 | 20·1 | 37·3 | 18·9 | 3·4 | ·8 |
| " | " | Mixed Oats | ·7 | 4·6 | 14·8 | 34·8 | 33·0 | 8·3 | 3·9 |
| " | " | .. Oats | 2·5 | 20·4 | 27·7 | 31·3 | 13·9 | 2·2 | 2·2 |
| " | .... | Mixed Oats | ·6 | 4·8 | 17·3 | 37·7 | 32·6 | 4·5 | 2·5 |
| " | " | Mixed Oats | 1·5 | 9·1 | 23·6 | 39·5 | 21·1 | 3·6 | 1·6 |
| " | " | Mixed | 6·7 | 19·6 | 23·1 | 33·0 | 15·4 | 1·9 | ·6 |
| " | " | Mixed Oats Bunt | 4·2 | 19·4 | 30·4 | 33·9 | 9·3 | 1·7 | ·4 |
| " | " | Mixed | ·9 | 7·7 | 22·4 | 45·9 | 19·1 | 1·9 | 2·1 |
| " | " | Mixed Oats | 1·9 | 11·2 | 24·8 | 37·0 | 16·5 | 3·7 | 4·9 |
| " | " | Mixed | 1·1 | 5·6 | 17·2 | 43·8 | 25·4 | 5·3 | 1·5 |
| " | " | Mixed | 4·2 | 18·0 | 35·0 | 34·4 | 5·7 | ·8 | 1·6 |
| " | Stnw | ............ | 8·6 | 26·8 | 30·1 | 22·9 | 9·6 | 1·5 | ·5 |
| " | " | Mixed | 1·1 | 8·5 | 19·7 | 41·2 | 25·4 | 3·1 | ·8 |
| " | " | ............ | 4·9 | 31·4 | 29·5 | 25·2 | 6·9 | 1·6 | ·3 |
| Junee Road, Temora | Impl. | ............ | 2·0 | 13·8 | 30·0 | 41·3 | 11·2 | 1·2 | ·6 |
| Temora | P. St. | .. Oats Bunt | 2·9 | 10·5 | 21·8 | 41·8 | 18·3 | 3·0 | 1·9 |
| Mimosa | " | Mixed | 1·4 | 6·9 | 22·4 | 38·8 | 24·7 | 3·8 | 1·9 |
| " | R. St. | ............ | 1·6 | 7·6 | 22·8 | 39·2 | 21·8 | 3·8 | 3·3 |
| Barmedman | P. St. | Mixed | 1·5 | 11·9 | 25·8 | 41·4 | 16·5 | 2·2 | ·8 |
| Junee Road, Temora | " | .. Oats | 1·0 | 9·8 | 23·8 | 42·6 | 18·8 | 2·8 | 1·2 |
| Stockinbingal | R. Tu. | ............ | 1·7 | 10·2 | 19·7 | 37·4 | 25·6 | 3·1 | 2·1 |
| Marengo | P. St. | .. Oats | 14·0 | 34·7 | 34·3 | 13·8 | 2·7 | ·2 | ·3 |
| Grenfell Road | " | Mixed | 14·6 | 40·2 | 27·0 | 14·9 | 2·6 | ·4 | ·3 |
| Grenfell | " | .. Oats | 1·9 | 12·4 | 29·0 | 32·9 | 17·4 | 3·9 | 2·2 |
| Garangula | Wh. T. | Mixed | 6·6 | 22·5 | 35·8 | 29·4 | 4·1 | ·3 | 1·2 |
| Barwang | Tusc. | ............ | ·6 | 5·7 | 20·7 | 48·9 | 21·8 | 1·8 | ·6 |
| Bethungra | R. Wh. | Mixed | 2·6 | 9·8 | 27·7 | 31·4 | 15·9 | 4·1 | 8·6 |

SAMPLES of New South Wales Seed Wheat, Graded to show Quality, 1897-8—*continued.*

| Locality. | Variety. | Remarks. | 3·25 | 3·00 | 2·75 | 2·50 | 2·25 | 2·00 | Tailings. |
|---|---|---|---|---|---|---|---|---|---|
| Murrumburrah | P. St. | ............ | 6·4 | 18·4 | 34·0 | 30·9 | 6·3 | 1·7 | 2·1 |
| " | R. Tu. | ............ | 9·5 | 40·7 | 29·2 | 16·8 | 2·1 | ·5 | 1·1 |
| " | N. Rd. | Mixed | 1·6 | 7·9 | 10·0 | 44·5 | 27·5 | 3·8 | 4·6 |
| " | " | Mixed | 1·6 | 7·9 | 10·0 | 44·5 | 27·5 | 3·8 | 4·6 |
| Young | P. St. | Mixed Oats | 13 9 | 47·1 | 24·2 | 11·9 | 2·4 | ·2 | ·3 |
| " | " | Mixed Oats | 16·3 | 38·8 | 28·0 | 12·9 | 2·8 | ·2 | ·3 |
| " | " | Mixed | 14·0 | 41·7 | 29·5 | 12·7 | 1·7 | ·3 | ·3 |
| " | " | Mixed Oats | 17·0 | 41·2 | 27·0 | 12·3 | 1·7 | ·3 | ·4 |
| " | Stnw. | Oats | 7·0 | 22·1 | 30·8 | 28·4 | 8·4 | 1·8 | 1·5 |
| Bowning | Wh. L. | Mixed | 12·2 | 23·7 | 25·5 | 23·4 | 7·7 | 2·7 | 5 0 |
| " | P. St. | Mixed Oats Bunt | 3·3 | 17·5 | 24·2 | 35·1 | 13·6 | 4·3 | 2·1 |
| Illabo | Wh. L. | ............ | 1·4 | 6·9 | 19·4 | 49·8 | 20·7 | 1·7 | .. |
| Yass | " | Mixed | 20·0 | 37·2 | 28·6 | 12·0 | 1·9 | ·2 | ·2 |
| Grabben Gullen | .... | Oats Bunt | 7·4 | 29·4 | 34·6 | 23·8 | 3·0 | ·6 | 1·3 |
| Yass | Wh. L. | ............ | 40·8 | 47·2 | 10·5 | 1·5 | .. | .. | .. |
| " | R. Wh. | ............ | 6·5 | 18·1 | 25·1 | 33·4 | 14·0 | 2·5 | ·5 |
| " | Rd. L. | ............ | 11·4 | 30·0 | 37·5 | 19·7 | 1·3 | ·1 | .. |
| Harden | Stnw. | Mixed | 9·5 | 29·9 | 27·1 | 22·9 | 5·8 | 1·6 | 3·2 |
| Near Cowra | .... | ............ | 3·5 | 10·9 | 22·3 | 30·7 | 15 7 | 5·2 | 2·4 |
| Cowra | Stnw. | ............ | 2·5 | 21·4 | 24·2 | 32·0 | 12·8 | 3·3 | 3·7 |
| " | " | ............ | 2·6 | 12·4 | 30·2 | 34·3 | 15·8 | 2·6 | 2·1 |
| " | " | Oats | 5·1 | 17·2 | 26·3 | 31·6 | 15·8 | 3·2 | ·8 |
| West Ville | Wh. L. | ............ | 4·2 | 10·4 | 24·5 | 50·0 | 9·3 | ·8 | ·8 |
| Back Creek | Y. Tu. | Oats | ·8 | 9·8 | 21·3 | 39·4 | 23·6 | 4·3 | ·9 |
| Morongla Creek | " | Mixed | 1·9 | 5·6 | 14·9 | 44·0 | 25·7 | 3·8 | 4·2 |
| Cowra | P. St. | ............ | ·8 | 6·9 | 18·3 | 44·2 | 25·5 | 3·3 | ·9 |
| " | " | Mixed Oats Bunt | ·2 | 2·9 | 11·2 | 39·7 | 37·0 | 5·7 | 3·2 |
| Molong | " | Mixed Oats Bunt | 1·8 | 14·1 | 19·4 | 37·6 | 20·5 | 5·8 | ·8 |
| Canowindra | Wh. W. | ............ | 2·2 | 8·7 | 17·0 | 30·3 | 30·5 | 9·2 | 2·2 |
| " | P. St. | ............ | 3·0 | 16·4 | 30·9 | 35·8 | 11·6 | 1·6 | ·7 |
| " | " | ............ | 3·1 | 24·9 | 31·7 | 24·5 | 8·9 | 1·6 | 5·4 |
| Blayney | Wh. L. | Mixed Oats | 15·9 | 44·8 | 26·0 | 10·3 | 1·9 | ·8 | ·3 |
| Barry | " | Mixed | 4·2 | 11·7 | 25·7 | 35·5 | 18·6 | 2·6 | 1·5 |
| Blayney | P. St. | Oats | 17·1 | 43·5 | 25·6 | 10·6 | 1·4 | 1·1 | ·7 |
| Avondale | Wh. L. | Mixed | 4·9 | 14·4 | 23·8 | 19·7 | 32·8 | 2·6 | 1·7 |
| Near Orange | " | Mixed Oats | 9·1 | 43·6 | 32·7 | 7·8 | 1·9 | 2·6 | 2·1 |
| Forest Reefs | Wh. H. | Mixed Oats | 13·9 | 52·1 | 23·8 | 7·1 | 2·3 | ·6 | ·1 |
| Raglan | .... | Bunt | ·5 | 9·9 | 16·6 | 42·4 | 24·9 | 3·6 | 2·6 |
| " | .... | Oats | ·4 | 6·5 | 18·7 | 42·1 | 25·6 | 4·1 | 2·6 |
| " | Wh. L. | Mixed | 3·3 | 14·9 | 31·5 | 30·3 | 16·6 | 2·4 | 1 0 |
| Perth | " | ............ | 4·8 | 14·3 | 20·3 | 36·1 | 18·8 | 3 9 | 1·8 |
| " | " | ............ | 24·1 | 52·4 | 22·6 | 1 0 | ·1 | .. | .. |
| White Rock | " | Mixed | 5·0 | 13·3 | 20·5 | 38·6 | 16·6 | 4·4 | 1·5 |
| Broula | P. St. | ............ | 1·6 | 14·5 | 27·3 | 41·5 | 12·5 | 1·9 | ·8 |
| White Rock | Wh. L. | Mixed | 5·4 | 15·4 | 21·3 | 33·4 | 20·3 | 2·7 | 1·5 |
| George's Plains | Wh. T. | Oats | 7·9 | 33·8 | 29·5 | 21·2 | 4·8 | 1·2 | 1·6 |
| Millthorpe | Bl. L. | ............ | 3·9 | 12·9 | 26·6 | 40·2 | 12·1 | 2·9 | 1·3 |
| W. Orange | ... | ............ | 10·2 | 38·2 | 24·6 | 16·5 | 6·4 | 1·6 | 2·6 |
| Shaw | .... | Mixed Oats | 1·8 | 6·1 | 14·3 | 33·4 | 27·7 | 9·9 | 6·7 |
| Near Orange | Stnw. | Oats | 11·5 | 18·3 | 27·4 | 33·8 | 6·7 | 1·2 | 1·2 |
| Millthorpe | F. Fr. | ............ | 31·5 | 43·2 | 15·7 | 5·9 | ·8 | 1·1 | ·7 |
| Spring Hill | P. St. | Mixed Oats | 12·1 | 46·7 | 28·6 | 8·3 | 1·7 | 1·2 | 1·3 |
| " | Wh. H. | ............ | 16·0 | 49·7 | 24·0 | 5·8 | 1·5 | 2·0 | 1·1 |
| Near Orange | P. St. | ............ | 17·3 | 39·0 | 20·2 | 10·7 | 3·4 | 2·4 | 7·1 |
| Burrowa River | Wh. T. | Mixed | 2·4 | 14·2 | 28·8 | 44·2 | 9·4 | ·7 | ·3 |
| Wattamondarra | P. St. | ............ | 1·6 | 4·4 | 16·3 | 37·5 | 28·7 | 8·8 | 2·7 |
| Neville | " | ............ | 20·7 | 37·7 | 21·3 | 13·2 | 3·8 | 1·3 | 2 0 |
| Evans' Plains | Wh. L. | ............ | 6·1 | 15·1 | 23·6 | 34·1 | 16·6 | 3·1 | 1·3 |
| Brewongle | " | Mixed | 6·3 | 14·7 | 19·6 | 38·1 | 17·2 | 2·5 | 1·6 |
| Barwang | " | Mixed | 3·4 | 7·7 | 12·6 | 51·4 | 22·4 | 1·7 | ·9 |
| Kialla | Tal. | ............ | 8·6 | 19·8 | 43·6 | 21·9 | 4·7 | ·9 | ·6 |
| Garangula | Wh. W. | ............ | 2·9 | 9·4 | 31·4 | 44·5 | 8·0 | 1·4 | 2·4 |
| Evans' Plains | Wh. L. | Mixed | 4·7 | 16·4 | 20·6 | 32·2 | 18·1 | 3·6 | 1·4 |
| Lucknow | " | ............ | 13·4 | 41·7 | 24·5 | 13·0 | 3·8 | 1·2 | 2·5 |
| Jerrawa | R. Wh. | Mixed | 1·4 | 8·4 | 17·8 | 39·5 | 26·4 | 5·2 | 1·5 |
| Demondrille | Stnw. | Mixed Oats | 5·9 | 40·5 | 24·3 | 19·3 | 7·5 | 1·7 | ·7 |
| Wattamandarra | " | ............ | 2·8 | 16·7 | 27·9 | 31·7 | 13·4 | 4·7 | 2·8 |
| Currawang | P. St. | ............ | 4·7 | 21·8 | 39·3 | 27·2 | 5·2 | ·8 | 1·0 |
| Jeir | " | ............ | 13·7 | 32·8 | 40·8 | 12·3 | ·4 | .. | .. |
| " | Wh. L. | ............ | 21·3 | 43·7 | 33·9 | 1·2 | .. | .. | .. |
| " | Rd. L. | ............ | 11·4 | 20·9 | 46·1 | 15·4 | ·1 | .. | .. |
| Adelong Crossing | Wh. L. | Mixed | 6·1 | 29·2 | 35·7 | 24·7 | 3·7 | ·2 | ·4 |
| " | P. St. | Mixed Oats | 8·9 | 26·9 | 35·7 | 19·3 | 7·6 | 1·1 | ·7 |
| South Gundagai | Wh. T. | ............ | ·8 | 7·4 | 21·7 | 49·7 | 19·3 | 1·2 | ·8 |
| Near Gundagai | ... | ............ | 7·5 | 20·2 | 25·0 | 27·5 | 16·9 | 2·4 | ·7 |

SAMPLES of New South Wales Seed Wheat, Graded to show Quality, 1897–8—*continued.*

| Locality. | Variety. | Remarks. | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|---|---|
| Gundagai | .... | Mixed Oats | 4·7 | 15·2 | 27·9 | 34·0 | 14·8 | 2·5 | ·9 |
| Tamworth | ... | ............ | 13·1 | 30·6 | 29·1 | 18 9 | 5·8 | 1·0 | 1·5 |
| " | P. St. | ............ | 20·0 | 32·6 | 18·3 | 16·7 | 7·6 | 2·4 | 2·4 |
| Moor Creek | Stnw. | Oats | 18·6 | 34·4 | 22·7 | 13·6 | 7·3 | 2·7 | ·7 |
| " | Wh. T. | Mixed | 4·9 | 10·6 | 25·7 | 37·5 | 18·0 | 2·0 | 1·2 |
| Near Tamworth | P. St. | Mixed | 11·2 | 33·7 | 33·1 | 19·1 | 2·2 | ·4 | ·3 |
| Moonbi | R. Pr. | Mixed | 2·5 | 12·9 | 20·8 | 42·2 | 16·9 | 2·4 | 2·4 |
| " | Stnw. | Oats | 17 6 | 36·9 | 24·0 | 16·6 | 2·9 | ·6 | 1·5 |
| " | F. Gl. | Oats | 39·8 | 37·8 | 9·9 | 5·4 | 1·3 | 1·6 | 4·2 |
| Bective | Bl. V. | Mixed | 37·0 | 28·8 | 15·1 | 11·6 | 3·3 | 2·1 | 2·0 |
| " | Stnw. | ............ | 51·5 | 29·8 | 9·6 | 6·0 | 2·1 | ·7 | ·5 |
| " | P. St. | ............ | 29·5 | 43·4 | 14·7 | 7·6 | 3·0 | 1·1 | ·7 |
| Quirindi | G. Dr. | Mixed Oats | 4·8 | 10·9 | 26·5 | 42·2 | 12·2 | 1·9 | 1·5 |
| " | P. St. | Mixed Oats | 10·8 | 17·5 | 28·5 | 28·2 | 11·9 | 1·5 | 1·6 |
| Manilla | Stnw. | ............ | 20·5 | 27·9 | 17·0 | 13·4 | 10·1 | 6·4 | 4·8 |
| Upper Manilla | Aust. | ............ | 20·7 | 24·8 | 30·0 | 16·3 | 3·9 | 2·2 | 2·2 |
| " | P. St. | Mixed Bunt | 25·6 | 36·8 | 18·6 | 10·8 | 3·8 | 1·7 | 2·6 |
| Glenmore | " | ............ | 1·5 | 9 7 | 21·0 | 37·5 | 23·6 | 4·9 | 1·7 |
| Wallabadah | Wh. T. | Mixed Oats | 4·1 | 15·5 | 32·6 | 37·8 | 9·2 | ·5 | ·2 |
| Nundle | " | Mixed Oats | 10·1 | 25·0 | 37·5 | 22·9 | 3·7 | ·5 | ·4 |
| Duri | Wh L. | ............ | 6·4 | 20·4 | 30·5 | 33·8 | 8·2 | ·4 | ·2 |
| Nemingha | Stnw. | Oats | 53·2 | 28·0 | 8·7 | 5·8 | 1·8 | ·9 | 1·6 |
| Castle Mountain | G. Dr. | Oats | 10·5 | 19·8 | 26·7 | 32·5 | 8·7 | ·9 | 8 |
| " | " | ............ | 8·4 | 22·2 | 32·8 | 28·7 | 4·1 | 1·8 | 2·0 |
| Brooman | P. St. | ............ | 1·8 | 11·4 | 19·5 | 36·2 | 25·1 | 4·5 | 1·5 |
| Glen Innes | Sp. W. | Oats | 21·8 | 40·1 | 24·5 | 9·8 | 2·7 | ·8 | ·4 |
| " | Vlvt. | Mixed | 26·4 | 41·1 | 24·0 | 6·1 | 1·5 | ·6 | ·5 |
| Begginbeggin | R. Tu. | ............ | 3·9 | 14·8 | 34·5 | 37·7 | 7·3 | ·8 | ·8 |
| Morongla Creek | Wh. T. | ............ | 1·6 | 8·6 | 16·2 | 37·5 | 25·7 | 7·5 | 2·9 |
| [?] | .... | Mixed Oats | 1·1 | 7·6 | 20·7 | 23·4 | 35·6 | 5·5 | 5·9 |
| Berthong | G. Dr. | Mixed Bunt | 3·8 | 12·5 | 30·4 | 39·2 | 10·4 | 1·4 | 2·4 |
| Begginbeggin | Npr. | Mixed | 5·1 | 18·2 | 34·1 | 28·6 | 8·6 | 1·2 | 4·1 |
| Limestone Creek | Stnw. | ............ | 18·3 | 38·6 | 22·6 | 11·7 | 5·3 | 1·6 | 1·9 |
| Water Vale | " | Mixed | 1·5 | 10·0 | 24·8 | 27·5 | 27·5 | 5·4 | 3·4 |
| Warrangong | Wh. L. | Oats | 5·6 | 24·5 | 6·6 | 54·0 | 5·7 | 1·4 | 2·3 |
| Ashburton | " | Mixed Oats | 10·8 | 33·9 | 31·0 | 18·7 | 2·6 | 1·0 | 2·0 |
| Quong Dong | P. St. | ............ | ·9 | 7 7 | 24·4 | 46·5 | 18·6 | 1·9 | ·2 |
| " | Stnw. | ............ | ·9 | 9·6 | 25·3 | 37·5 | 16·3 | 5·9 | 4·4 |
| " | .... | ............ | .. | 3·6 | 10·8 | 37·4 | 37·0 | 7·6 | 3·6 |
| [?] | .... | Mixed | .. | .. | .. | .. | 58·0 | 42·0 | .. |
| [?] | .... | Mixed | 4·3 | 18·2 | 35·1 | 35·3 | 4·9 | ·6 | 1·4 |
| Water Vale | P. St. | Mixed Oats | 2·5 | 18·3 | 28·2 | 31·7 | 13·4 | 3·7 | 1·9 |
| Newry | " | Mixed | 2·4 | 12·9 | 26·9 | 40·9 | 13·0 | 1·6 | 2·2 |
| Springfield | " | Mixed | 3·4 | 19·5 | 33·0 | 30·3 | 10·9 | 1·6 | 1·3 |
| Clear Hills | " | ............ | 4·9 | 30·1 | 32·4 | 27·7 | 4·0 | ·5 | ·4 |
| North Berry Jerry | " | Mixed Oats | ·8 | 9·6 | 26·1 | 48·7 | 13·3 | 1·2 | ·2 |
| Bomory Villa | " | Oats | 3·7 | 20·9 | 28·5 | 29·4 | 8·7 | 2·6 | 6·2 |
| Coree | " | ............ | 2·3 | 9·8 | 18·8 | 37·6 | 24·2 | 5·5 | 1·7 |

### *Analysis of the foregoing Table.*

The table of the gradings shows a number of interesting features, according to the way in which it is analysed. If we separate the varieties we observe that Steinwedel yields the best results on the average:—

| Grades. | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|
| Steinwedel | 10·7 | 24·8 | 25·3 | 24·3 | 10·5 | 2·4 | 1·9 |

The miscellaneous samples are, however, nearly as good, giving practically the same grade figures.

Next these, but considerably poorer, come Purple Straw and White Lammas, of which the latter is a trifle the better. The unnamed samples are the poorest, some of them being extremely rubbishy. See the following table.

TABLE of Averages.

| Name of the Variety. | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|
| Steinwedel, 31 samples .. | 10·75 | 24·8 | 25·3 | 24·3 | 10·5 | 2·4 | 1·9 |
| Miscellaneous, 15 „ . | 10·2 | 18·6 | 24·5 | 30·2 | 12·0 | 2·3 | 2·4 |
| White Lammas, 36 „ .. | 6·2 | 24·0 | 25·3 | 30·4 | 11·2 | 1·9 | 1·1 |
| Purple Straw, 113 „ .. | 6·6 | 20·3 | 26·2 | 30·4 | 12·4 | 2·4 | 1·7 |
| White Tuscan, 21 „ .. | 4·4 | 17·0 | 26·4 | 34·7 | 13·9 | 2·0 | 1·5 |
| Without name, 15 „ .. | 3·8 | 14·2 | 22·1 | 30·1 | 21·1 | 6·2 | 2·3 |

From this average table it is possible to derive the average of all the samples, the *average for the State*, as we may term it :—

| Grades. | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|
| State average .. .. .. | 6·9 | 19·8 | 24·9 | 30·0 | 13·5 | 2·9 | 1·8 |

The State average may be more conveniently stated by giving approximate figures, as follows :—

| Grades. | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|
| **State average** .. .. .. | **7·** | **20·** | **25·** | **30·** | **13·** | **3·** | **2·** |

These figures can easily be carried in the mind during the following discussions and comparisons, all the more easily after studying Figures 12 and 20. Of course it is not meant to imply by the term State average that the above figures are exactly the average that would have been obtained, if, say, ten thousand samples had been examined in the same manner as this smaller number of samples. Nevertheless, it is extremely doubtful if a larger number of examinations would have materially changed the figures, and this justifies us in using the term, thus qualified.

It will be noted that the various samples are described in the text as very good, good, medium, poor, bad, and very bad. These words refer mainly to the size of the grains composing the samples.

### *Average Quality of First-class Sample.*

In order to make clearer the precise meaning to be attached to these words let us for a moment consider what are the qualities of a first-class sample of wheat so far as relates to the size of its grains. As the Purple Straws are largely grown let us take as an example a sample of ordinary Purple Straw grain of first quality. Such a sample grades up as follows :—

| Grades. | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|
| Farmer's Friend .. .. .. | 46·96 | 39·63 | 8·01 | 3·79 | 1·09 | ·29 | ·23 |

These figures are the result of grading three first-class samples grown in three successive years, as described in the article on the grading of wheats already cited. It will be observed that 86 per cent. of the grains belong to the two largest grades. Experience has shown that the yield from the last four grades is less from equal numbers of seeds, and that the crop is of inferior quality. Consequently any sample that graded up so as to throw the bulk of its grain into these grades would be of inferior quality. The sample given above may be taken as somewhere near perfection, as the plants from which it was derived were picked plants. It is, however, quite safe to say that any good sample of Purple Straw should throw three-fourths of its grain into the first three grades.

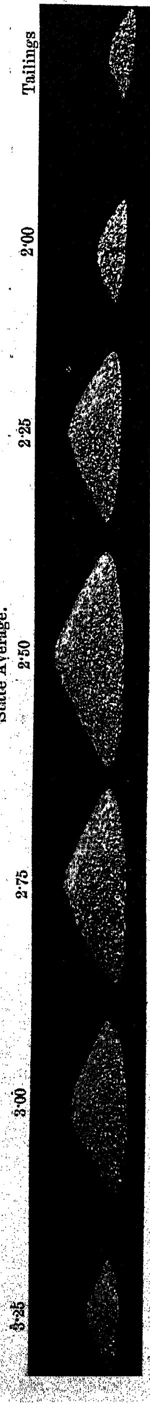


**Fig. 12.**—Average sample of New South Wales seed-wheat, graded and placed in piles to show the relative proportions of large and small grains in the sample. The largest grains are in the piles at the left, and the smallest grains are in the piles at the right. It will be seen from this illustration that the average New South Wales sample of seed-wheat is about equal in quality to the medium sample shown in Figure 7, and far below the quality of a perfectly grown sample of its own type, such as is shown in Figure 13, at the other side of this page. This proves that the average New South Wales sample of seed-wheat shows very little evidence of grading preparatory to sowing.

### *What we should Aim at.*

It will be found on reference to the source of the figures relating to the sample of Farmer's Friend, that they represent a high grade of grain, in fact something like the perfection of growth under normal conditions in one of the principal wheat-growing districts of the State. It is well to bear this fact in mind, and not lay too much stress on comparisons between this well-nigh perfect growth and the averages derived from these present examinations of our ordinary seed wheat. There is, I think, no mistake more commonly made by experts and enthusiasts than that of over-estimating the rate at which we may reasonably expect to approach the perfect standard which they can so easily picture to themselves from their vantage ground of superior knowledge and foresight. While it is advisable, therefore, to always present the ultimate goal toward which all are striving, it is often more useful to make comparisons with a standard more easily within reach.

Particular attention is therefore invited to the comparisons made between the seed-wheat of the better farmers of the State and that of the remaining three-fourths or four-fifths.

There is no doubt, as will be seen when we come to the later pages of this report, that the stamina of *our wheat crops would be very much improved if the example set by our better growers could be widely imitated, and it is equally beyond doubt that their example could be profitably followed at once. There is no difficulty in the way.*

Such bad seasons as the present would be fraught with much less loss from disease and poor growth if our wheat crops had the additional stamina derived from the use of plump graded seed.

### *The Illustrations.*

It is desirable that the percentage figures used in these pages should convey a definite idea to the reader's mind. Accordingly, 100 ounces of particular samples have been divided up and placed in piles according to the percentage figures. See illustrations 12, 13, etc.

While this method of grading the wheat and placing it in piles is in its way very effective in

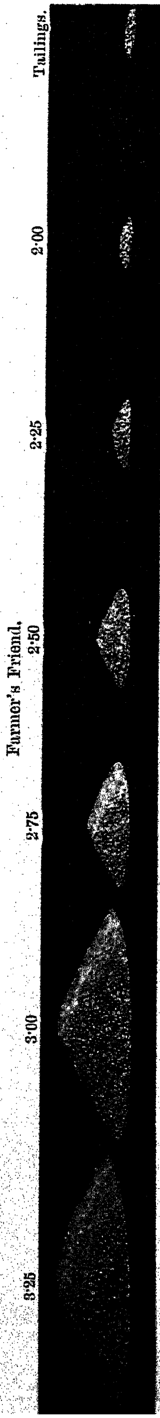


**Fig. 13.**—A well-nigh perfect sample of Farmer's Friend, a Purple Straw wheat, graded and placed in piles to show the proportion of the various grades of grain in the sample. The left-hand pile is composed of the largest grains in the sample, while the right-hand pile is composed of the smallest grains in the sample. It will be noted what a large proportion of the grains belong to the two highest grades. The threshing of the sample was such that every grain was saved. The same sample is shown in a different way in Fig. 14, which should be compared with this. This serves to illustrate a good, in fact well-nigh perfect, sample of Purple Straw wheat.

showing the nature of a given sample of seed it has some drawbacks. In the first place the illustration does not show the striking difference in the sizes of the grains composing the various piles. Again the method of piling is not the most effective way of showing the precise relative amounts of the different grades. However those accustomed to wheat are so used to seeing it in piles that this method has been adopted as one that will appeal to the senses through the ordinary channels.

A better method is that adopted in Fig. 14, on this page, in which every grain is shown, and in its natural size, as is explained in the small paragraph relating to the illustration.

### *How to Judge the Tabulated Gradings.*

All the grains of the lower grades in any sample will lower its quality as seed wheat, the very lowest grades of course being a greater defect than those immediately higher. In harmony with this criterion the samples in the tables may be classed as good or bad according as a majority of their grains are found in the upper or lower grades. Thus a sample that graded :—

| | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|
| Purple Straw. | 3·1 | 19·0 | 26·7 | 37·2 | 11·4 | 1·5 | 1·1 |

would be classed as *medium*, while one that graded as follows :—

| | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|
| Purple Straw. | ·7 | 4·6 | 14·8 | 34·8 | 33·0 | 8·3 | 3·9 |

would be called *poor* or bad. One grading into the lowest grades, as follows :—

| | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|
| Purple Straw. | 0·0 | 3·6 | 10·8 | 37·4 | 37·0 | 7·6 | 3·6 |

would be called *very bad*, especially if it contained, as would probably be the case, dirty rubbish and split grains.

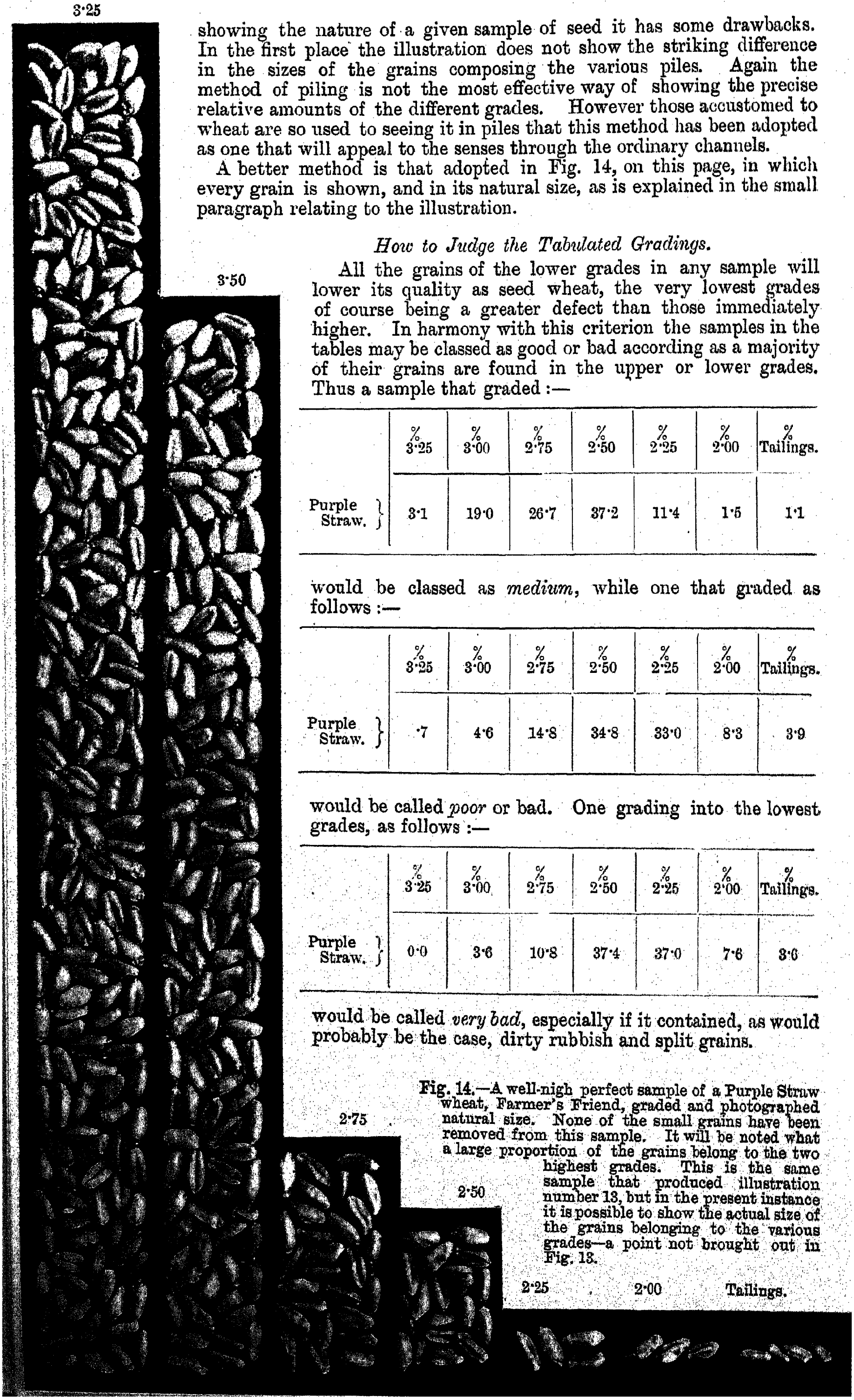


**Fig. 14.**—A well-nigh perfect sample of a Purple Straw wheat, Farmer's Friend, graded and photographed natural size. None of the small grains have been removed from this sample. It will be noted what a large proportion of the grains belong to the two highest grades. This is the same sample that produced illustration number 13, but in the present instance it is possible to show the actual size of the grains belonging to the various grades—a point not brought out in Fig. 13.

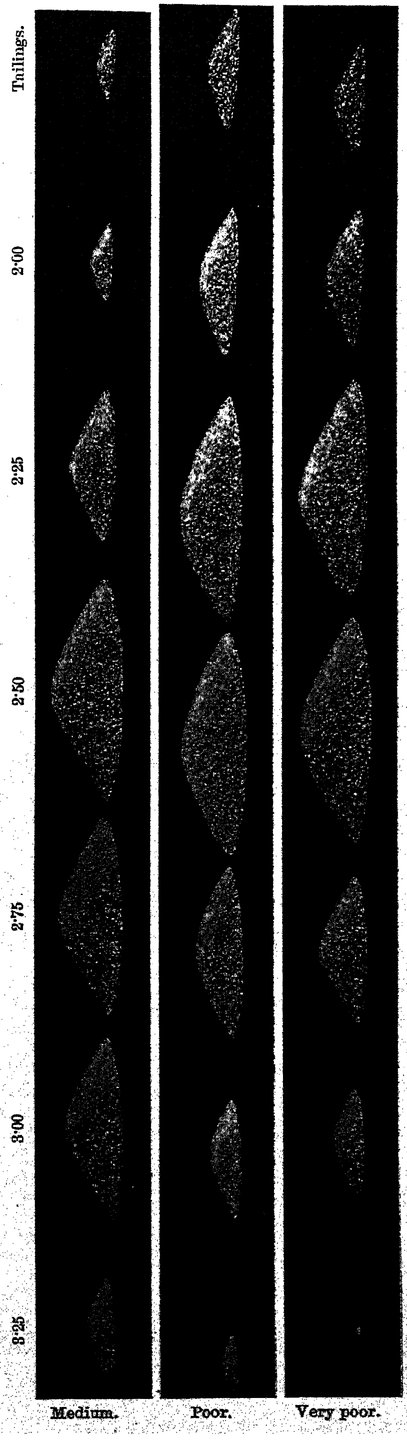
It will be observed that some of the farmer's samples grade up better than the perfect sample given on page 42. This is explained by the fact that the perfect sample was the *entire product of the plants, large grains and small*, the harvesting having been conducted with special reference to securing every single grain. On the other hand, the small grains had been already removed from some of the samples collected from farmers as they were being sown. It will be seen, therefore, that it is impossible to compare such samples with those graded from the three years' experiment cited from Vol. VIII, with any other object than that of securing a rough result.

About fifty of the samples tabulated on pages 38 to 41 show evidence of having been more or less graded preparatory to use as seed-wheat. The others are as they came from the stripper and cleaner, or thresher and cleaner. In other words about three-fourths of our farmers use wheat for seed without removing the small grains and the inferior and useless portions.

Much as this is to be regretted, something of the kind must have been predicted by anyone who has observed the customs of our wheat-growers, especially if he had also discovered how commonly the fallacy about the good properties of small and shrivelled grains is upheld in this country. It is however useful to have these tabulated figures, derived from adequate and careful examination, as a weapon to combat this error. It is probably too much to expect of ordinary human nature that the advocates of this fallacy will retract their utterances; a few facts such as are recorded on later pages may, however, silence them and cause them to turn their love for paradoxical statements into some other channel.

### *Practice of our Best Growers.*

The evidence of previous grading and cleaning is apparent in the table on pages 38 to 41 in those cases where the three final figures are all very low, thus showing that the smallest grains have



**Figs. 15, 16, 17.**—Showing how the medium quality and poor samples of Purple Straw, Lammas, and other prominent Australian wheats grade up. These should be compared with Figure 13, which shows a perfect sample of a similar class of wheat. In these figures the piles at the left are composed of the largest grains in the sample, while those at the right are composed of the smallest grains in the sample. The poorer the sample the larger the piles at the right. The very poor sample had actually no grains in the left-hand pile, the position of the pile being marked by a single grain. These illustrations together with Figure 13, may be compared with Figures 12, 18, and 19, in which the actual condition of New South Wales seed-wheat is pictured.

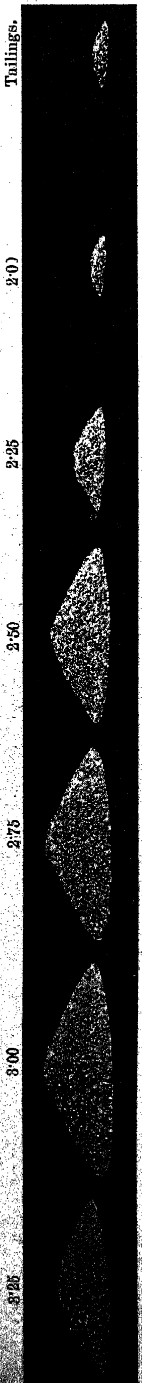


**Fig. 18.**—A very interesting photograph, inasmuch as it is a graphic illustration of the practice of the best 25 per cent. of New South Wales wheat-growers. The average sample of the fifty-seven best lots of seed-wheat collected was graded and photographed to produce this illustration, which should be compared with other similar illustrations given on the adjacent pages. The largest grains are in the left-hand pile, and the smallest grains are in the right-hand pile. It will be seen that the quality of this sample is much below that of a perfectly grown sample of Purple Straw, as shown in Fig 13.

been removed. Here are three such instances:—

| Grades. | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|
| Steinwedel .. | 53·2 | 28·0 | 8·7 | 5·8 | 1·8 | ·9 | 1·6 |
| Purple Straw .. | 12·9 | 29·7 | 35·0 | 19·8 | 2·6 | ·1 | ·1 |
| White Lammas.. | 21·3 | 43·7 | 33·9 | 1·2 | .. | .. | .. |

It will be observed that in the White Lammas the small stuff had been completely removed. In the case of the Steinwedel the small grains had been removed, but the "White Heads" and coarse dirt remained to make 1·6 per cent. of the weight. In the grading of the samples all such matters were taken from the various grades and relegated to the tailings, and it is necessary to keep this in mind in estimating from the tables which samples had been previously graded for seed purposes.

I take it as unmistakable evidence of grading for seed purposes when all three percentages of the lower grades in the table are very low, as, for instance, in the following case:—

| Grades. | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|
| Purple Straw .. | 17·4 | 41·7 | 31·3 | 8·7 | ·3 | ·1 | ·4 |

A Purple Straw that gave such low percentages of tailings and of grades 2·00, 2·25, and 2·50, must have been sifted in order to remove the small seeds, and so make it better for seed purposes.

There are a good number of such instances in the table. If the samples of this type be selected from the table it will be seen that their number is about thirty. I think, however, that about twenty other samples show that something had been done to make them better for seed purposes by the use of the cleaning machine, thus making in all some fifty instances in which there is evidence of an effort on the part of the farmer to improve his seed-wheat by cleaning it or grading it, by which is meant running it several times through a cleaning machine or winnowing machine.

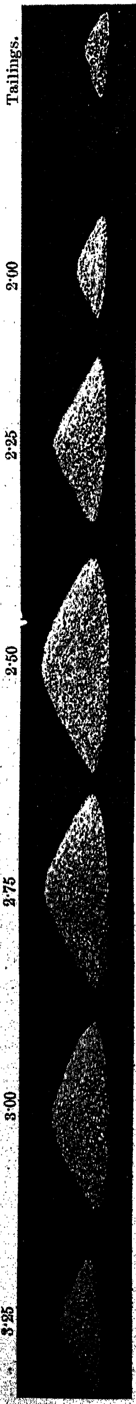


**Fig. 19.**—A very interesting illustration, showing graphically the condition in which the great majority of New South Wales wheat-growers sow their seed. The average New South Wales sample was graded and placed in piles: the largest grains being in the left-hand piles, and the smallest grains in the right-hand piles. On comparison it will be seen that the average condition in which our seed-wheat is sown is considerably below that of the medium sample shown in Fig. 15, and far below that of the seed used by our best growers, as shown in Fig. 18, and very far below that of a perfectly grown sample of New South Wales wheat, as shown in Fig. 13.

It is of interest to see what effect these efforts at grading have had on the seed wheat. I have, therefore, taken fifty-seven cases that show evidence of grading, and I find on averaging them (see p. 50) that they give the following interesting figures, which are graphically illustrated in Figs. 18 and 21 :—

| Grades. | %<br>3·25 | %<br>3·00 | %<br>2·75 | %<br>2·50 | %<br>2·25 | %<br>2·00 | %<br>Tailings. |
|---|---|---|---|---|---|---|---|
| Fifty-seven best Samples .. .. .. | 15·8 | 32·4 | 27·7 | 18·8 | 3·8 | ·8 | ·7 |

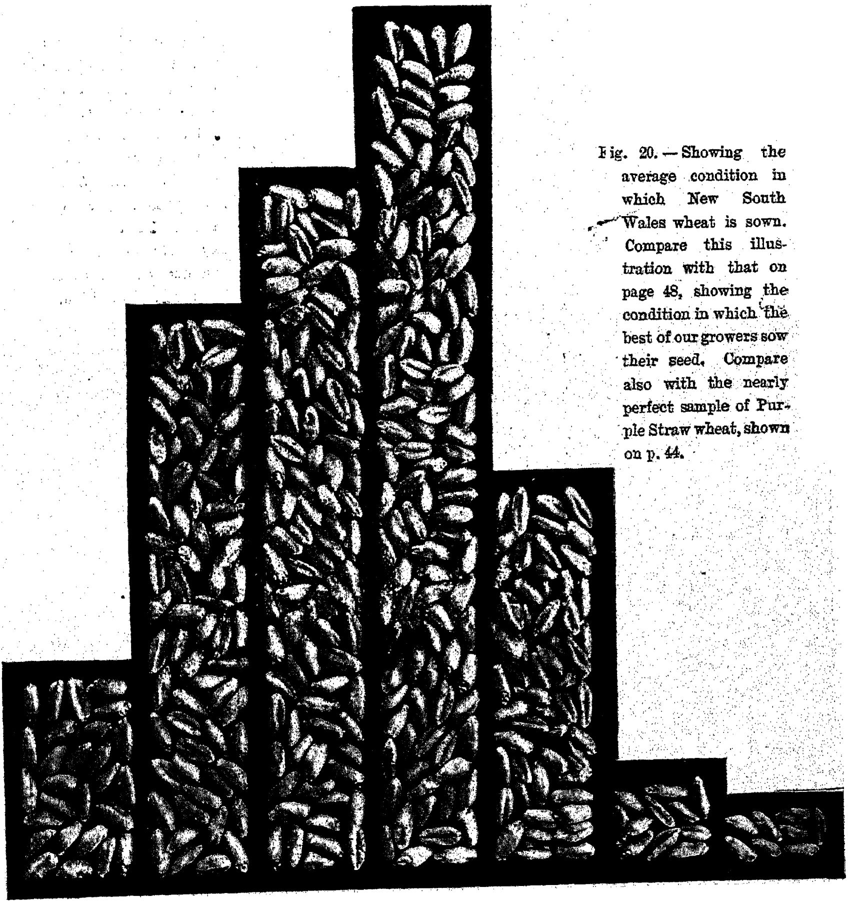


Fig. 20.—Showing the average condition in which New South Wales wheat is sown. Compare this illustration with that on page 48, showing the condition in which the best of our growers sow their seed. Compare also with the nearly perfect sample of Purple Straw wheat, shown on p. 44.

It will be seen that even these graded samples on the average fall very much short of the normal product of perfectly-grown Purple Straw wheat. If, however, we take the best of the samples shown in the table, we find that they considerably excel the most perfect normal sample that could be grown.

*To What Extent should Farmers Grade their Seed Wheat?*

These figures just quoted, as the result of averaging fifty-seven samples of manifestly-graded samples of seed-wheat as they came from the farmers' hands at sowing-time, show the extent to which our best farmers consider it advisable to re-clean their seed-wheat with a view to improving its qualities. It would, of course, be easy to go on cleaning the seed until it was well nigh impossible to further improve its quality as seed, but the question of expense comes in, and at a certain point the cleaning ceases to be profitable. At what point does additional cleaning become a losing operation? That is the critical question. The answer that our best farmers give is this, as derived from our tables: *An ordinary sample of wheat of the varieties most grown in the State may profitably be cleaned until it reaches the condition represented by the figures last quoted,*—in other words until it reaches the condition shown in Fig. 21 on this page.

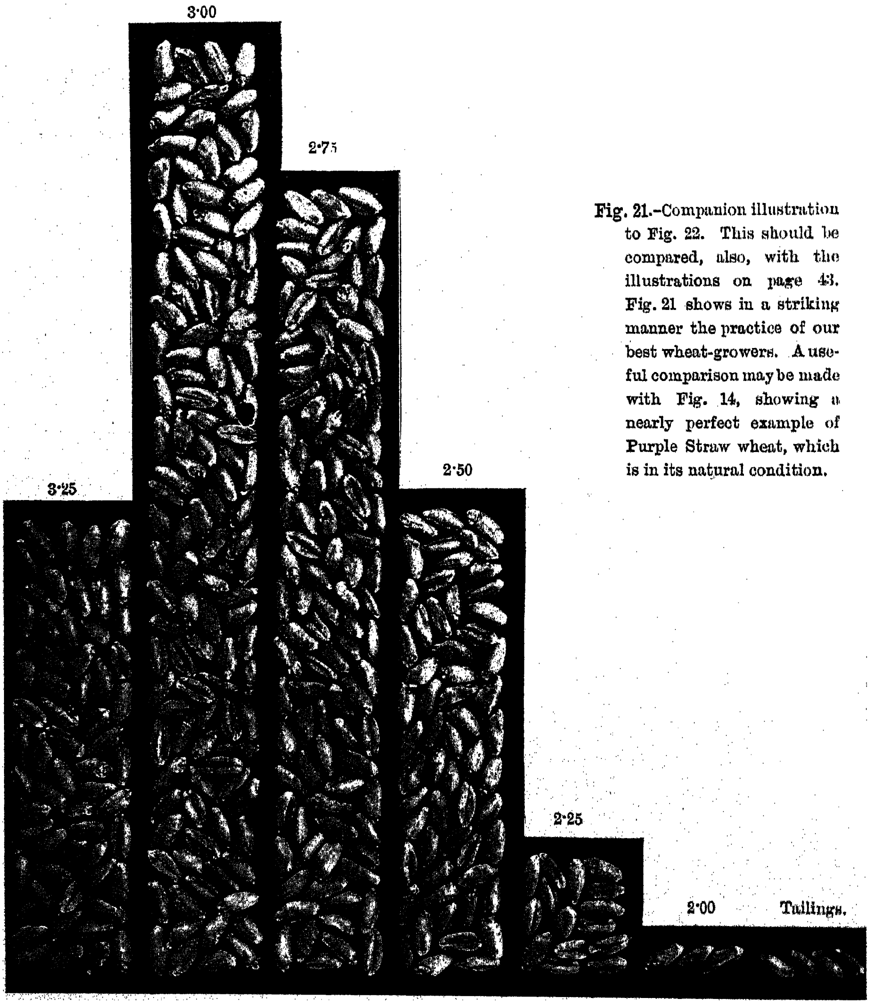


**Fig. 21.**—Companion illustration to Fig. 22. This should be compared, also, with the illustrations on page 43. Fig. 21 shows in a striking manner the practice of our best wheat-growers. A useful comparison may be made with Fig. 14, showing a nearly perfect example of Purple Straw wheat, which is in its natural condition.

In order that this answer may be made as clear as possible, photographs have been made from a sample so cleaned, and the pictures are presented in a variety of ways, so as to give as accurate an idea as possible of the opinion of our best wheat-growers. See illustrations on this and the succeeding pages. The number of these growers, as I have already pointed out, is from one-fifth to one-fourth of our total number. *Would* *it not be wise for the remaining three-fourths to give the most careful heed to this opinion of their confreres,* backed up as it is by their practice, as proved from an impartial examination of their seed taken at the time it was being sown?

A great deal of our wheat is grown under conditions ordinarily called precarious. Our seasons are less reliable than those of many parts of the world where wheat is grown. Hence, on account of this uncertainty of our climate, the vicissitudes that probably confront our wheat crop at the outset of any season, are exceptionally great. Now, we know that in tiding over the untoward circumstances of climate small and weak seed stand a poorer chance than large plump seed, a much poorer chance than under favourable climatic conditions. That is the great and special reason why in such a climate as ours we should give particular attention to the quality of our seed. Under our conditions this attention is likely to yield a maximum of profit. The same amount of attention to the same point in a country where the climate is more uniform and reliable would not be likely to be attended with an equal amount of profit.

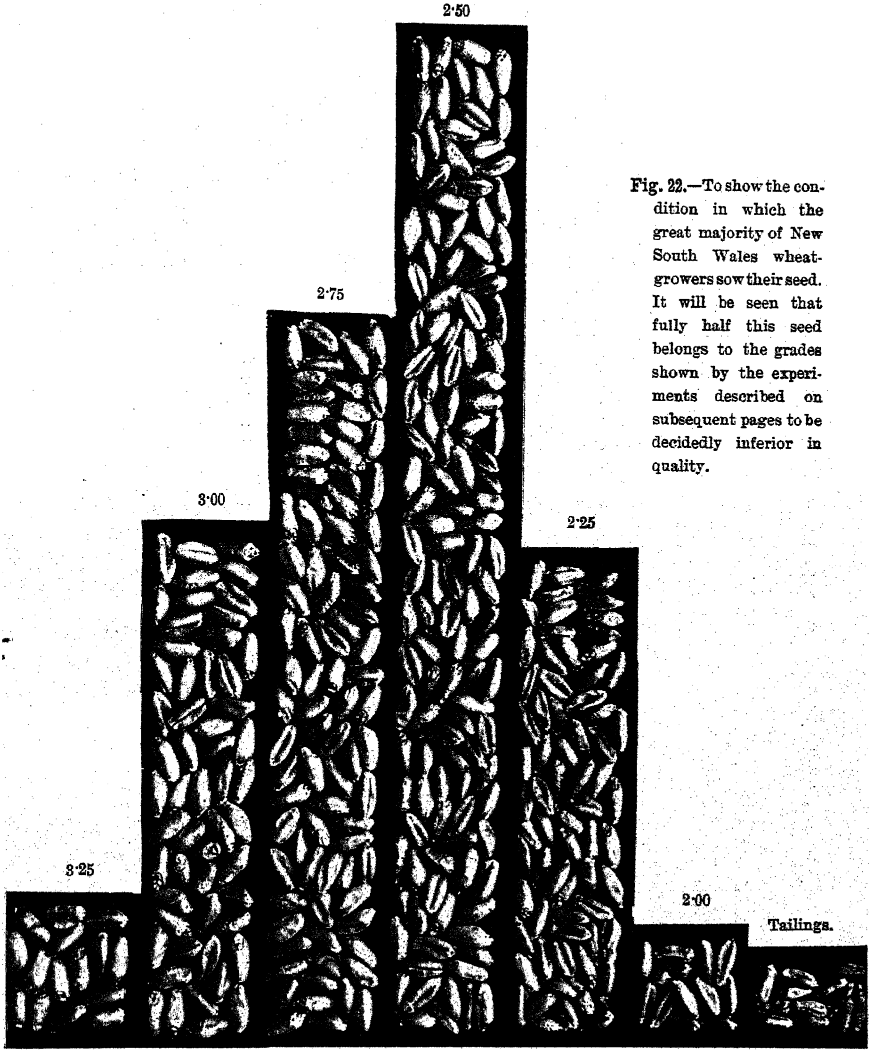


**Fig. 22.**—To show the condition in which the great majority of New South Wales wheat-growers sow their seed. It will be seen that fully half this seed belongs to the grades shown by the experiments described on subsequent pages to be decidedly inferior in quality.

### *Our Usual Practice.*

As opposed to the samples that show evidence of preparation for seed purposes by extra winnowing or sifting, or both, we may examine the remaining three-fourths that do not show such evidences. The average of these samples will show the condition in which three-fourths of our seed wheat is put into the ground. We find this average, graphically illustrated in Fig. 22 on the previous page, to be :-

| Grades. | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. |
|---|---|---|---|---|---|---|---|
| Condition in which three-fourths of our seed wheat is sown .. .. .. .. | 4·0 | 16·8 | 24·7 | 33·7 | 15·7 | 3·1 | 2· |

It will be seen that one-fifth is of the 2·25 grade, or smaller, and that half of it is of the 2·50 grade, or smaller. This is a poor showing in comparison with the practice of our best farmers, and a still poorer showing in comparison with the commercial possibilities of the situation, for it must be borne in mind that the average shown even by the *best* portion of New South Wales samples contains too large a proportion of easily and cheaply removable small and low-profit seed.

THE fifty best samples of Seed Wheat submitted.

| No. | % 3·25 | % 3·00 | % 2·75 | % 2·50 | % 2·25 | % 2·00 | % Tailings. | Address. |
|---|---|---|---|---|---|---|---|---|
| 13 | 23·0 | 43·5 | 20·9 | 9·1 | 2·8 | ·4 | ·4 | A. Sleeman .. .. Jerilderie. |
| 26 | 25·6 | 36·8 | 18·6 | 10·8 | 3·8 | 1·7 | 2·6 | Edw. Bowman .. Upper Manilla. |
| 20 | 17·0 | 41·2 | 27·0 | 12·3 | 1·7 | ·3 | ·4 | J. Cockle .. .. Young. |
| 25 | 14·6 | 40·2 | 27·0 | 14·9 | 2·6 | ·4 | ·3 | A. Taylor .. .. Grenfell-road. |
| 34 | 12·9 | 29·7 | 35·0 | 19·8 | 2·6 | ·1 | ·1 | John Westerdale .. Finley. |
| 6 | 31·5 | 43·2 | 15·7 | 5·9 | ·8 | 1·1 | 1·7 | Reuben Ezzy.. .. Millthorpe. |
| 21 | 14·0 | 41·7 | 29·5 | 12·7 | 1·7 | ·3 | ·3 | J. C. Watson .. .. Young. |
| 44 | 6·9 | 24·8 | 32·2 | 27·9 | 7·2 | ·9 | ·3 | Jno. Warren .. .. Dubbo. |
| 24 | 14·0 | 34·7 | 34·3 | 13·8 | 2·7 | ·2 | ·3 | Patrick Kerin .. Marengo. |
| 28 | 20·7 | 37·7 | 21·3 | 13·2 | 3·8 | 1·3 | 2·0 | Mr. French .. .. Neville. |
| 12 | 12·1 | 46·7 | 28·6 | 8·3 | 1·7 | 1·2 | 1·3 | J. D. Baker .. .. Spring Hill. |
| 23 | 16·3 | 38·8 | 28·0 | 12·9 | 2·8 | ·2 | ·3 | S. Caldwell .. .. Young. |
| 14 | 13·7 | 32·8 | 40·8 | 12·3 | ·4 | .. | .. | James Cornell .. Jeir. |
| 43 | 6·5 | 29·8 | 29·3 | 29·8 | 3·8 | ·5 | ·2 | R. Graham .. .. Berrigan. |
| 17 | 17·1 | 43·5 | 25·6 | 10·6 | 1·4 | 1·1 | ·7 | W. M. Masters .. Blayney. |
| 42 | 10·0 | 22·4 | 33·7 | 29·7 | 3·7 | ·4 | ·3 | T. Dugan .. .. Near Dubbo, |
| 10 | 29·5 | 43·4 | 14·7 | 7·6 | 3·0 | 1·1 | ·7 | G. Simmonds.. .. Bective. |
| 33 | 11·2 | 33·7 | 33·1 | 19·1 | 2·2 | ·4 | ·3 | Richard Brown .. Near Tamworth. |
| 11 | 39·8 | 37·8 | 9·9 | 5·4 | 1·3 | 1·6 | 4·2 | Chaffey Bros... .. Moonbi Railway Station. |
| 19 | 13·9 | 47·1 | 24·2 | 11·9 | 2·4 | ·2 | ·3 | E. Taylor .. .. Young. |
| 6(a) | 17·4 | 41·7 | 31·3 | 8·7 | ·3 | ·1 | ·4 | Jno. Jones, senior .. Nyngan. |
| 45 | 2·0 | 20·0 | 37·0 | 38·0 | 2·3 | ·4 | ·4 | John Robbins.. .. Near Berry Jerry. |
| 48 | 4·0 | 18·0 | 36·1 | 34·0 | 6·2 | 1·7 | .. | C. J. Turner .. .. Coolamon. |
| 2 | 21·3 | 43·7 | 33·9 | 1·2 | .. | .. | .. | James Cornell .. Jeir. |
| 22 | 11·4 | 26·9 | 46·1 | 15·4 | ·1 | .. | .. | James Cornell .. Jeir. |
| 31 | 11·4 | 30·0 | 37·5 | 19·7 | 1·3 | ·1 | .. | Henry Boswell .. Yass. |
| 15 | 15·9 | 44·8 | 26·0 | 10·3 | 1·9 | ·8 | ·3 | T. Quigley .. .. Blayney. |
| 38 | 8·6 | 19·8 | 43·6 | 21·9 | 4·7 | ·9 | ·6 | Patrick Kennedy .. Kialla. |
| 9 | 16·0 | 49·7 | 24·0 | 5·8 | 1·5 | 2·0 | 1·1 | Thomas Martin .. Spring Hill. |
| 8 | 13·9 | 52·1 | 23·8 | 7·1 | 2·3 | ·6 | ·1 | P. McGlynn .. .. Forest Reefs. |
| 49 | 6·4 | 20·4 | 30·5 | 33·8 | 8·2 | ·4 | ·2 | P. H. Osborne .. Duri. |
| 41 | 6·1 | 29·2 | 35·7 | 4·7 | 3·7 | ·2 | ·4 | James Turner .. Adelong Crossing. |
| 18 | 20·0 | 37·2 | 28·6 | 12·0 | 1·9 | ·2 | ·2 | D. Murray .. .. Yass. |
| 3 | 40·8 | 47·2 | 10·5 | 1·5 | .. | .. | .. | Henry Boswell . Yass. |
| 1 | 24·1 | 52·4 | 22·6 | 1·0 | ·1 | .. | .. | W. Hirst .. .. Perth. |
| 29 | 13·4 | 41·7 | 24·5 | 13·0 | 3·8 | 1·2 | 2·5 | Peter Floyd .. .. Lucknow. |
| 32 | 17·6 | 36·9 | 24·0 | 16·6 | 2·9 | ·6 | 1·5 | Chaffey Bros... .. Moonbi Railway Station. |
| 5 | 51·5 | 29·8 | 9·6 | 6·0 | 2·1 | ·7 | ·5 | G. Simmonds .. .. Bective. |
| 7 | 58·2 | 28·0 | 8·7 | 5·8 | 1·8 | ·9 | 1·6 | W. A. Chaffey .. Nemingha House. |
| 35 | 18·6 | 34·4 | 22·7 | 13·6 | 7·3 | 2·7 | ·7 | Thos. Pullman .. Moore Creek. |
| 30 | 9·5 | 40·7 | 29·2 | 16·8 | 2·1 | ·5 | 1·1 | James Gordon .. Murrumburrah. |
| 37 | 10·1 | 25·0 | 37·5 | 22·9 | 3·7 | ·5 | ·4 | A. Crowley .. .. Nundle. |
| 39 | 7·9 | 33·8 | 29·5 | 21·2 | 4·8 | 1·2 | 1·6 | H. Pearce .. .. George Plains. |
| 4 | 26·4 | 41·1 | 24·0 | 6·1 | 1·5 | ·6 | ·5 | Mr. Fultz .. .. Glen Innes. |
| 46 | 10·5 | 19·8 | 26·7 | 32·5 | 8·7 | ·9 | ·8 | John Foot .. .. Castle Mountain. |
| 16 | 21·8 | 40·1 | 24·5 | 9·8 | 2·7 | ·8 | ·4 | Mr. Fultz .. .. Glen Innes. |
| 27 | 37·0 | 28·8 | 15·1 | 11·6 | 3·3 | 2·1 | 2·0 | G. Simmonds .. .. Bective. |
| 36 | 20·7 | 24·8 | 30·0 | 16·3 | 3·9 | 2·2 | 2·2 | Edward Bowman .. Upper Manilla. |
| 47 | 4·3 | 18·2 | 35·1 | 35·3 | 4·9 | ·6 | 1·4 | R. W. McGill .. .. |
| 40 | 7·4 | 29·4 | 34·6 | 23·8 | 3·0 | ·6 | 1·3 | John Kelleher .. Grabben Gullen. |

*(To be continued.)*

# Irrigation in the Western Division.

(Continued from page 1112.)

J. WRIGHT, C.E.

The natural flow of the Darling River and its tributaries is almost valueless because of its irregularity and fluctuations varying from 0·00, as at present, to 30,000 cubic feet per second or more during floods, nine-tenths of which goes to waste because we have no means of utilising or conserving it.

The first important question for consideration is—Can we regulate the known fluctuations of flow and so bring them into harmony with our requirements, whether for navigation, irrigation, and stock purposes, or all combined. The intervals between the fluctuations are very great, thereby rendering an answer to the question very difficult. We can accomplish it to a certain extent by impounding, and that extent will naturally depend upon the quantity impounded. If the navigation of the Darling is to be maintained, then any system of impounding must of necessity be carried out beyond or above the navigation limit, and that, of course, limits our power of impounding to the tributaries by the erection of weirs, and to the erection of dams and sluices and flood-gates at the confluence of the many blind watercourses, depressions, and anabranches which exist on both sides of the Darling. Although very large bodies would by these means be impounded, it is a question whether, with our experience of the present drought, there would be sufficient water at disposal to afford continuous navigation. Certainly the navigation period would be extended, but to what extent it would be very difficult to determine, and would be dependent on the quantity of water impounded. In connection with the system of impounding proposed or suggested above, Mr. G. Gordon, in his report to the director of the River Darling Navigation Company, says:—"From my observations of the flow of the river at the time of inspection, I believe that the summer supply will at all times be sufficient to compensate for the loss by lockage and evaporation, but as by means of the weirs the anabranches and the lakes and lagoons back from the river could be more readily filled, and as the water could, *by means of flood-gates and sluices, be retained* in them until it was required, an abundance of water could, even in the driest years, be made a certainty, while the supply to the back country would be very greatly improved." Mr. Gordon was possessed with an imperfect or superficial knowledge of the river's *regime*, notwithstanding his being acknowledged as the highest authority on hydraulic engineering in Australasia, for at the time he made his report the river was only navigable to Menindie, and on his return he could not reach Wentworth, or else he over-estimated the quantity of water that could be thrown back by the flood-gates. Mr. Gordon's and Mr. Darley's estimates for locking the Darling were about the same, viz., £500,000, or £1,000 per mile, with an annual cost of £10,000, or £20 per mile for maintenance, repairs, and wages of keepers, &c., and for this outlay very little revenue would be obtainable. The following table shows the amount of tonnage from 1891 to 1900, as per the Government Statistician:—

| | Wentworth tonnage. | Other port tonnage. | Total tonnage. | Average tonnage per steamer. | No. of calls by steamers at ports. | Average tonnage per call. |
|---|---|---|---|---|---|---|
| 1891 | 37,998 | 31,753 | 69,751 | 871·9 | ........ | ........ |
| 1892 | 31,071 | 28,781 | 59,852 | 748·15 | ........ | ........ |
| 1893 | 39,888 | 33,359 | 73,247 | 915·6 | ........ | ........ |
| 1894 | 47,224 | 41,403 | 88,627 | 1,107·8 | ........ | ........ |
| 1895 | 37,489 | 40,723 | 78,212 | 977·7 | 731 | 107 |
| 1896 | 38,623 | 36,800 | 75,429 | 942·8 | 1,524 | 49·49 |
| 1897 | 24,522 | 48,894 | 73,416 | 917·8 | 1,250 | 59·66 |
| 1898 | 22,319 | 39,919 | 62,238 | 777·9 | 1,324 | 47·00 |
| 1899 | 21,646 | 47,596 | 69,242 | 865·5 | 1,489 | 46·50 |
| 1900 | 20,466 | 58,867 | 79,233 | 990·4 | 1,534 | 51·60 |

During the above period (ten years) Mr. Coghlan states the rivers Murray and Darling were navigable. It will be noted that the Wentworth tonnage, the bulk of which goes up the Darling, has decreased from 47,224 tons in 1894 to 20,466 tons in 1900 = 26,758 tons, upwards of 60 per cent., and that the tonnage of the other river ports have increased during the same period 17,464 tons—from 41,403 tons to 58,867 tons,—showing conclusively that the Darling, as a transporting medium, is either losing favour or that the requirements of producers and suppliers are met by other means of transit. Those who favour navigation contend that if it were continuous the tonnage would increase, as it has done at the Murray ports. I cannot agree with that contention. In any case the cost would be too great, and when the proposed railway to Wilcannia is constructed the river freights must decrease, and to such an extent as will render river carriage unprofitable, though I fail to see how, under existing conditions, with 80 steamers engaged in the trade, it is profitable now when this average annual tonnage amounts to only 990 tons each.

The contention that water carriage is cheaper than railway carriage may be, and is, true for certain freights; but wherever the two have entered into direct competition railways always carry the greater tonnage. The most striking and convincing instance of this fact comes from, or is to be found in, America in connection with the wheat carriage from west to east, or from the Lakes at Buffalo to New York. The Erie Canal, in 1862, carried nine-tenths of the grain grown in the west, in 1883 one-third, in 1892 one-sixth, and in 1900 one-eighth, though the freight by rail is nearly double of that by canal. And again, of the 450 millions of bushels of grain and corn grown in the States tributary to the Mississippi River in 1898 less than 2 per cent. was carried on that river to St. Louis, though the freights on the river were 50 per cent. less than by rail to New York and the over-sea freights from St. Louis to Liverpool were only two-thirds of that from New York. In England, on the Continent, and in America the railways, in proportion to their mileage, carry from three to twenty times the amount of tonnage that the canals do also in proportion to their mileage, though in both America and on the Continent no tolls are charged.

Returning to the provision of water question, I think it must be acknowledged that the only methods possible to obtain a supply for the Western District is by impounding the flood waters and the bringing of the underground supplies by artesian bores and wells to the surface for utilisation. If it were permissible—and I hope it may be—to construct weirs upon the Darling and other rivers, thereby converting them into a huge reservoir 500 miles in length, much of the difficulty would be overcome, for a large proportion of it could be utilised for irrigation, and the raising of the waters would not only cause a greater distribution but it would render the basin system of irrigation possible in several known places: (1) Such as the depressions that exist between the Queensland border and the Darling along the course of the Paroo down to, and even beyond, where its waters disappear; (2) from the lower Talywalka through the series of lakes that run down to Lake Bullabulka and Bobby Hob; (3) from Lake Pamamaroo to Lakes Menindie, Cawndilla, and Tandan. The basin system of irrigation has been practised from the earliest times in Egypt. The annual overflow waters of the Nile fill a large depression some miles distant from its banks. A number of these depressions are connected by drains; the water is held in the upper depression or basin for a sufficient length of time to saturate the subsoil to such extent as it will and does contain ample moisture for the growth of a cereal crop of 130 days. The water is then run into the next basin, and so on until it returns to the Nile again miles lower down. Whether such a system would be successful in the Darling country experiment only can determine, but its success in Egypt is undoubted. However, were it not put in practice, the filling of the depressions would place a large quantity of water at disposal, for which a beneficial use no doubt would be found.

Failing the construction of weirs on the river Darling it will then be absolutely necessary to impound all the water possible in the tributaries, commencing with flood-gates for holding up the flood waters and the erection of dams on or in the blind watercourses and weirs on the tributaries, selecting the most favourable sites for the storage of the greatest quantity at the least cost, and proceed upward to their higher altitudes, where I know, of my own knowledge and personal observation, of sites for storage reservoirs of immensely larger capacity than is possible on the more level country of the plains and at much less cost in proportion to the quantity stored or impounded. Regarding the weirs: No doubt exception will be taken to their height and their tendency to raise the bed of the streams and the flood-level. Both can readily be reduced to a minimum by putting in weirs with movable timber superstructures, such as those used for irrigation purposes in California and Colorado. That the construction of such weirs will cause a larger area of land to be submerged cannot be denied, but that will be an advantage, because the silt deposited will act as a fertiliser and it will be possible to conserve a much larger quantity of water in the country distant from the streams weired. To what extent the artesian waters will supplement the supply by impounding the flood waters will be dependent upon the number of bores put down and their yield. Later on I hope to furnish details of the quantity of water impounded by the dams on the Yanko, Colombo, and Billabong Creeks in Riverina in order to demonstrate what can and has been done on what may be termed blind watercourses.

In any scheme of irrigation it is essential that the requirements of the crop to be tested should be understood, and to afford an idea of how much water is necessary for the production of various kinds of vegetation, I append a table which, I think, will prove valuable :—

DAILY Consumption of Water by Various Plants, &c., (Soils of Average Good Fertility).

| | | | | | | |
|---|---|---|---|---|---|---|
| Lucerne ... | 0·134 to 0·267 inch | During their period of Growth. | | Barley ... | 0·094 to 0·101 ,, | During their period of Growth. |
| Grasses, Meadow | 0·122 to 0·287 ,, | | | Potatoes ... | 0·038 to 0·055 ,, | |
| Oats ... | 0·140 to 0·193 ,, | | | Oak Trees ... | 0·030 to 0·038 ,, | |
| Maize ... | 0·110 to 0·157 ,, | | | Fir Trees ... | 0·020 to 0·043 ,, | |
| Clover ... | 0·140 ,, | | | Ash ... | 0·026 to 0·053 ,, | |
| Vineyard ... | 0·035 to 0·031 ,, | | | Elm ... | 0·030 to 0·061 ,, | |
| Wheat ... | 0·106 to 0·110 ,, | | | Poplar ... | 0·024 to 0·054 ,, | |
| Rye ... | 0·091 ,, | | | | | |

The above figures were deduced from actual experiment by M. Risler, a Swiss savant, and were afterwards confirmed by the French Professor of Agriculture at Mountsouris Observatory. The Mountsouris experiments extended over a number of years. The grain was grown in earth in metallic boxes, and similar boxes without grain were used to determine the evaporation. It was found that to produce 1 lb. of wheat required the expenditure of from 800 lb. to 2,400 lb. of water, the lesser quantity being required on the fertile soils. In the case of wheat the maximum consumption of water occurred at the flowering period, after which it diminished to the ripening and then ceased.

From these experiments it was deduced that a field of grain, as oats, wheat, barley, or rye, may absorb between seeding and harvest, from 13 in. to 15 in. of water, and grass may absorb more than double that quantity during the same period, *i.e.*, from 130 to 140 days.

[*] "The effect of water on fertility explains the difference in the yield of different fields of grain at the same time, and of the different yields of the same field in different years. It also serves to explain some points in hydrology as to the effect of the destruction of forests on the flow of streams. The table shows also that the quantity of water transpired by the leaves of cereals is greatly in excess of that transpired by the leaves of forest trees, which proves that the clearing and cultivating of forests do actually diminish the quantity of water in streams. It also explains how land, rich in the chemical constituents of certain grains, produce large crops with a small rainfall, as in North Dakota and Minnesota, where with a rainfall of but 17 in. 30 to 35 bushels per acre is no uncommon yield."

[*] *J. R. Hinton's Report to American Senate on Irrigation.*—On the richer soils of the arid regions in the Western States of America wheat has been grown profitably by the application of only 6½ in. of water during its growing period; and the applications of about 1 in. of water after each of four cuttings has been found to produce from 8 to 10 tons per acre of lucerne in various parts of America.

Professor Schlieden, of Jena, found for a mixture of oats and clover grown in earth contained in an iron box, which was weighed at intervals to determine the evaporation, a consumption of 0·0984 inch per day from the time of sowing to harvesting, a period of 129 days, equal to nearly 13 inches.

# The Stability of the Colouring Matter in Red Wines.

M. BLUNNO.

Of recent years one particular alteration of the wine, such as is due to the oxidase, has received much attention at the hands of experts in the Continent of Europe. "All sorts of moulds growing on red grape berries will destroy the colouring matter contained in the cells of the skin (*epicarp*), and consequently the wine will be poor in colour." Such was the explanation given by experts not very long ago as to why the wine from deteriorated grapes would be very poor in colour and the colour often be of a rusty shade, while the ordinary vigneron still believes the reason to be that the colouring matter of red grapes, which have absorbed a certain amount of water, "finds itself greatly diluted, and consequently its depth of colour is much reduced."

Thus it will seem strange when I say that the skins which are obtained from a crop of grapes after fermentation contain, even in wet vintages when wines are so poor in colour, as much colour as would suffice to give a ruby tint to as much white wine again, provided that special precautions were taken to make available such supply of *œnocyanine* (colouring matter of red wine); but if one only follows the time-honored system, whereby the wine-maker does not make the wine but allows the wine to make itself, no such boon is possible.. In the latter case, take a quantity of skins from a fresh heap and put it in a solution of alcohol and tartaric acid, which are two of the best solvents of *œnocyanine*, and you will find that very little colour is extracted. This is because the colouring matter of the grapes oxidises rapidly in contact with the air, and when it is oxidised it becomes insoluble even in liquids like alcohol and tartaric acid.

The colouring matter of grapes does not appear to be the same in all grapes, that of the French grape Aramon oxidises more readily than that of others, so does that of the Sangiovese, as far as my experience goes, in certain Italian districts.

Provided the grape juice is fairly acid, it is possible to prevent the oxidisation of the colouring matter during fermentation, and a ruby colour may be obtained in the wine even from grapes which are not extra rich in *œnocyanine* or from grapes that have been spoiled by rains, while grapes known to be very rich in colour can be made to give out this ingredient until they are exhausted, and so not only provide a rich colour in the wine directly made from them, but also enough *œnocyanine* be left in the skins to colour one or two extra crops of must of white grapes if the wine-grower should prefer to turn them into red wine.

Exposure of the colouring matter to the air causes it to become insoluble; the more so, the higher the temperature. But independently of this, that particular substance which is called *oxidase* and is secreted by the whitish mould *Botrytis cinerea* which readily spreads over the grapes during a prolonged period of wet weather, this *oxidase*, as the word itself implies, will effect a deep and quick oxidisation of the colouring matter, thus reducing the available supply of *œnocyanine* in a soluble form, both while fermentation is progressing and after the wine is made. In the latter case the oxidisation is made easier by the loss of carbonic acid occasioned by the frequent rackings, air being absorbed in its place. A rust-like deposit, *œnocyanine*, will form, and the wine will assume a rusty tint, the whole phenomenon being known by the two words *casse brune*.

The Riverina wines, during their first year or eighteen months, show a richness of colour, for which they are much sought by wine-merchants. These same wines will, after that period, lose much of their pristine colour, and through the vermeil there are mingled flashes of yellow tint. There is no doubt that the rapid loss of intensity of colour is a depreciation in young dry wines which are to be used to to form the *charpente—i.e.*, the body of a blending.

The early precipitation of the colouring matter to a much larger extent than the age of the wine would warrant is the result of a rapid oxidisation of the *œnocyanine*, helped to a varying degree by the frequency of racking without taking the precaution of preventing too much air from freely mixing with the wine, by the smallness of the casks, the reduced thickness of their staves, the high temperature of the cellars, and the great evaporation which takes place under those circumstances, all of them conducive to the wine absorbing more oxygen than is necessary.

In the Riverina there is less fear of having to make wine from grapes tainted with mould; therefore, what is required to prevent the rapid loss of colour is to see that the must and the wine are not over-exposed to the air, and that the total acidity of the must ranges between 7 and 9 per 1,000, calculated as tartaric acid.

In the Hunter River and all other districts where the above-mentioned inconvenience is not at all infrequent, wine-growers have to do the same at all times, and more thoroughly when grapes are tainted with mould, because of the presence of the *oxidase*.

### The use of alkaline sulphites in wet vintages and at other times.

From present indications there is every likelihood of trouble with rain next vintage. If I should prove to be a bad prophet, the information I am about to give in this paper will stand good for the time when the wine-maker will have to deal with a crop of mouldy, soppy grapes, which is not a singular occurrence in the annals of certain wine districts of this State.

To my knowledge the process followed up by wine-growers in making wine from grapes deteriorated by a long period of rainy weather is much the same as that of any other year, barring a more or less superficial selection of the crop whereby grapes much too mouldy are crushed separately, and a low wine is made which is distilled afterwards.

The wine made from grapes affected by rain has the following characteristics:—Its alcoholic strength is below the normal; so is the proportion of acids, colouring matters, mineral substances, and all the other ingredients forming the body of the wine, which will be much like a wine diluted by a certain quantity of water.

Very often, however, the rainfall at vintage time is not so great as to cause a large dilution of the grape juice, and a well-constituted wine could be yet obtained therefrom if wine-makers would only prevent the action of a phalanx of germs of different natures which are responsible each for a particular deterioration of the wine.

In the January number, 1902, of this *Gazette*, I referred to the use of sulphurous acid as a controller of fermentation, and I gave the proportions of free sulphurous acid necessary for every 100 gallons of must to delay the starting of fermentation from twelve hours to six days, in order to allow the must to cool, and to extract a greater amount of colour from the skins, also, in case of white must, to permit the separation of the sediment and of the lighter bodies forming a crust on the surface.

In several cellars during last vintage the system was applied for the second time in making white wine, and the benefit anticipated was realised again, although the practice was only carried so far as pumping in the must a certain quantity of fumes of sulphur, the quantity of which was not exactly measured, while, on the other hand, the majority of it bubbled through and escaped as quickly as it was pumped in. No selected yeast was employed, the use of which is an integral part of the system when deteriorated grapes are used. The weather last vintage was fine throughout, and grapes sound; therefore, the application of the method, at least as far as its first stage gave results satisfactory enough to warrant its continuation in future under similar circumstances.

In this article I shall give prominence to the treatment of musts in making red wines by using sulphurous acid, or such substances as the potassium bi-sulphite, which, when put in the must, splits itself, and a quantity of sulphurous acid is originated.

The use of both sulphurous acid (fumes of sulphur) and alkaline sulphite or bi-sulphites is old, and that of the former in particular is ancient. I need not state the many operations in which fumes of sulphur are called into requisition in the treatment of wine; their use in the making of it, however, is only of very recent application, and generally unknown.

Sulphurous acid and alkaline sulphites are the only antifermentatives permitted within certain limits by modern legislation in wine-making or treatment of wine.

Fumes of sulphur will prevent and check many of its microbial alterations, as well as the precipitation of colouring matter in red wine (*casse brune*). Very seldom, however, when the alteration has already reached a certain stage, the primitive quality of the wine is restored, while sulphurous acid used at vintage time is more effective.

When a wine is properly made from the start, there is very little fear of it going wrong provided the usual attention is paid in its keeping; but a wine that has been made anyhow, or that has been allowed to make itself without heeding the numerous factors and circumstances which concur in the success, is always of indifferent quality, and susceptible of becoming unfit for consumption and a loss to the producer.

Sulphurous acid was first used in vinification in white wine making, either from white or from red grapes.

Its use was conceived for the purpose of obtaining a colourless white wine which in the later stages of maturity would acquire a brilliant straw colour.

It is evident then that the first effect of the sulphurous acid in white musts is decoloration, and it may seem to be a paradox when this same sulphurous acid is employed in making red wine with the view of obtaining a deep vermeil tint and also keeping the colouring matter left in the skins in a soluble form for future use. However, the same phenomenon occurs in red wine made with musts submitted to the action of sulphurous acid as it occurs in white wine, viz., momentary diminution of colour in the first stage, followed by more stable fixation later on.

The use of pure yeast, prepared in the laboratory, to substitute the natural alcoholic ferment of the grapes is an important part of the process. This artificially-prepared leaven, however, plays in this case more the role of "starter" than that of giving any grape crop the character of a great wine, as was wont in the early days of its adoption. Next to the role of starter the *levures* (selected yeast) certainly contribute to a purer alcoholic fermentation, whereby the grape sugar is totally split in the normal ingredients which we expect to find in a wine without the production of substances apt to taint it.

In the already-mentioned article published in the *Agricultural Gazette* of January last year I referred principally to the sulphurous acid as controller of fermentation, pointing out that, by checking the activity of the natural yeast, it allows the must to cool down before it begins to ferment, a very suitable service when the grapes reach the crusher at a relatively high initial temperature. It must be borne in mind, nevertheless, that fumes of sulphurous acid, if not properly administered, may prove too much of a check, the vitality of the yeast may be impaired, its prolification attenuated, and, consequently, taking a long time before finishing its work.

The question whether the alcoholic yeast may keep its vitality unimpaired, in spite of the presence of sulphurous acid, by getting used to it, as Müller Thurgau seems to think, or whether it does not, as maintained by Martinand, further scientific experiments will very likely solve. There would be nothing surprising, however, in Müller Thurgau's theory in view of the fact that alcoholic yeast may be made to keep its faculties in presence of certain quantities of hydrofluoric acid.

Whatever may be the truth in this matter, one fact is certain, that is, that unless the activity of yeast is preserved, the use of sulphurous acid on the must which it is desired to make into wine might have other than good effects.

Luckily the *modus faciendi* of the newly-advocated system may be independent of the theory, as it happens to meet in its technical details both theoretical views. I shall, therefore, describe it as applying to the making of red wines:—

In the evening, crush enough grapes to make a layer about 18 inches deep in the fermenting vat, sprinkle the must and skins with pure alcoholic yeast obtained from a laboratory, and stir the whole for a few seconds.

Next morning this must will be fermenting, so it is time to fill the vat, which will be done by pouring first one layer of must and skins, which have been sprinkled over with pure yeast, then another layer of must and skins not so treated, but into which a certain quantity of potassium bi-sulphite is well mixed.

Layers of must so variously treated are alternatively poured in the vat until it is about three-quarters full.

For 500 gallons of must, skins not included, a quart bottle of yeast and 1 lb. of potassium bi-sulphite are sufficient. From the quart bottle of yeast about 20 gallons of starter are prepared in the manner described in my previous articles; while the potassium bi-sulphite is dissolved in another 20 gallons of must. Each liquid is sprinkled over the proper layer from a can.

After the vat is filled nothing is done for the next twelve hours, when one-fifth of the must, that is, 100 gallons of the whole quantity taken as instance, is drawn from the bottom hole, and pumped over. Another one-fifth is drawn after another twelve hours, and pumped over again and so on, until fermentation is complete. If at any time fermentation should be so strong as to cause a rise of the temperature above 95° F., then 100 gallons of the must are drawn from the vat, 3 oz. of potassium bi-sulphite are dissolved in them, pumped over and mixed with the bulk. If this device should not check the rapid increase of the temperature of the fermenting mass, another 100 gallons of must may be drawn from the vat; they are treated with a similar quantity or less of potassium bi-sulphite, according to the actual temperature of the bulk, and pumped over again as before.

By following the method described above strictly in the respective quantities and proportions and sequence of details, fermentation will be much improved; the temperature of the fermenting juice is kept within limits, and a dry wine will be obtained having keeping as well as higher palatable qualities.

The reason for filling the vats by layers of must in the first instance alternatively treated with yeast or potassium bi-sulphite is to allow for a time the yeasted portion to set up vigorous fermentation, forming numerous colonies of young yeast, before the potassium bi-sulphite incorporated in the alternated layers diffuses itself through the whole and affects the activity of the ferment to any extent. By degrees, however, the substance thoroughly mixes all through the bulk under two influences—one, that of the ordinary law of solution of a solid soluble substance in a liquid; the other, that of the bubbles of carbonic acid, produced by the fermentation creeping through the mass, thus fairly keeping it stirred the whole time. By then the leaven is strong enough, and the cells of which it is composed so plentiful as to keep fermentation active and regular all through, without any sudden rise in the temperature of the fermenting liquid beyond the critical 95° F.

This system which I just described is at once one that commends itself for adoption when and where grapes are too hot and the wine-maker has no means of refrigeration for either grapes or must, also for the vinification of grapes that have been damaged by moulds, and also when a deep, bright ruby colour is wanted, having stability instead of the common tendency to rapid oxidisation followed by precipitation.

## The Intensity of Colour.

The colouring matter of the grapes is generally located in the tissues of the skins of the berries, and the ordinary crushing of the grapes is not sufficient to set it free.

It is an old practice in some districts of Southern Europe to place in an oven a portion of the grapes and heat them for a little while, so that they may yield more of the colour they contain; then they are mixed with the others not so heated (*acinato*, province of Avellino). The Sampayo system of keeping grapes in a heap for several days before crushing them is similarly based on the principle that a certain amount of heat will disgregate the tissues of the epicarp of the berries and give out the œnocyanine available.

Such practices, however, have but a local application, warranted by a long experience and by the particular chemical nature of the musts.

The intensity of colour is dependent on the chemical equilibrium of several ingredients of the must, and consequently of the wine. The maximum of colour corresponds to a perfect relation between the colouring matter, the tannic acid, and other acids, iron or any other like ingredient apt to precipitate the tannic acid and colouring matter.

When two red wines of different intensity of colour are blended it may be expected that the blend should have a mean intensity of colour; often, however, the colour falls short of this mean intensity on account of the precipitation of some colouring matter. This precipitation evidently was brought about by the change set up in the chemical composition of the blend, the relation between the œnocyanine, tannic acid and other acids, iron and other similar ingredients capable of precipitating the tannin and colour which existed in the wines previous to the blending having been disturbed by that operation.

As a general principle to a higher fixed acidity is connected a greater depth of colour in a red wine. Yet sometimes the wine with the higher acidity shows the less intensity of colour. In such cases the other ingredients are evidently not in that *desideratum* of proportion to which corresponds the highest intensity of colour.

Again, the must of the "Jacquez" grape, otherwise known as "Lenoir," is susceptible of giving a wine with a high-toned colour, provided that a certain amount of tartaric acid is added to the must. This is explained by the fact that the colouring matter of "Jacquez" is combined with the tannic acid and also with iron compounds, the

"Jacquez" variety containing unusual quantities of the latter. A higher fixed acidity is therefore necessary to keep in solution this complex combination.

The simple addition of tannic acid to the musts of some red grapes will in many cases make the colour of wines deeper and more stable.

On the other hand all bacteria and other micro-organisms responsible for the various "sicknesses" of wines are destructive of the colouring matter of the wine. A sick wine has as a rule a colour less intense than that of a sound wine. Rosenstielhs asserts that even the yeast can feed on the colouring matter of the wine, and thus be the cause of an undesired attenuation of colour. The yeast, however, would turn on the œnocyanine only when the quantity of tannic acid is rather below the normal, so that the yeast can be prevented from destroying the colouring matter by supplementing the shortage of tannin by an addition of tannic acid.

## How to Extract the Colouring Matter.

The process of making red wine, as described in the foregoing, will give wines in which the tone of colour is higher than in another wine made of the same grapes in the ordinary fashion, but will certainly not extract all the colouring matter of the skins.

To adopt here the practice named after its first advocate, Sampayo, would not meet local conditions, considering that all the efforts of the wine-maker in this country should be directed to starting fermentation at an initial temperature of about 65° to 70° F. Grapes reach the cellar at such a high temperature that if, in addition to this, they were left in a heap for even a few hours, fermentation would start without much delay, and the outer layers of the heap would soon undergo acetic fermentation, and the whole of the grapes would afterwards give a wine subject to the mannitic disease, *i.e.*, a sweet-sour wine. Nevertheless, the skins and pulp of grapes from which the juice has been extracted can be heated for five or ten minutes to a temperature as high as boiling point without their acquiring the particular burned taste, provided they are treated with a proportion of potassium bi-sulphite, *i.e.*, 1 lb. of this for a quantity of skins and pulp weighing about a ton. The bi-sulphite is previously dissolved in a small quantity of must, which is sprinkled over the skins and pulp while they are well turned over, so that it may be thoroughly incorporated. This done, skins and pulp are brought to a specially-constructed heating apparatus; their temperature is raised, and kept between 175° and 195° F. for five or ten minutes; but it is imperative that they be cooled before they are put in the must, which was previously squeezed out of them, placed in a fermenting vat, and treated as described in the foregoing paragraph.

By the time the skins and pulps are transferred to the fermenting vat, in which the must has been placed, this has commenced to ferment. The successive operations on this vat are the same as those referred to in the description of the other system in which the skins are not heated. When fermentation is completed the wine is drawn from the vat and stored in cask, and the skins are pressed in the usual way. Both wine and pressings will show an intensity of colour double that of a wine made with the same grapes after the ordinary manner.

Young wines extra rich in colouring matter, all other characters being equal, or equivalent, are more marketable than others with less colour. Some of my readers might point out that N.S.W. wines in general are never deficient in colour. It may be so in some districts, in others it is not so always. In any case, however, the great advantage in using sulphurous acid, or potassium bi-sulphite, consists in giving the colouring matter of wine a greater stability, so preventing the early precipitation of the œnocyanine, which is a great inconvenience in wines that have to form the basis of blends. Wines with such a tendency will be apt to precipitate their colouring matter even when blended. I noticed several full-bodied wines only in their second year which had lost the vermeil of the previous year; when stirred in the glass they formed a white foam instead of a red one. I saw also others having a rusty tint known in commerce as *pélure d'oignon,* that is, the colour of the peel of a Spanish onion, which is not enticing, and marks out a wine decrepit before its age. Even red table wines should have a decidedly bright ruby tint. Some so-called clarets, on the contrary, have a indefinable red-yellow, dirty colour, very different from the bright, flashing red, with a golden yellow rim sparkling through the crystal, which is so much admired in an old wine of high class. Wines which have not been made from the beginning in such a way as to well fix the natural colouring matter will always acquire this characteristic tint, especially if they are deficient in fixed acidity.

The fumes of sulphur directly mixed in the must, or indirectly, through the addition of potassium bi-sulphite, prevents the oxidisation of the colouring matter of the wine by absorbing (fixing) a certain quantity of the oxygen of the must. When fermentation sets in, the carbonic acid will gradually expel the fumes of sulphur, the former still protecting the colouring matter from oxidisation; however, a certain proportion of said fumes remain in the wine, and we shall see what becomes of them afterwards.

To derive the above-mentioned benefits from the action of sulphurous acid, it is necessary that the fumes be supplied to the must before and during fermentation. Once the colouring matter of the grapes has been fixed, there is no fear afterwards of its precipitation; as a matter of fact, for some time during the different cellar operations following the making there is not much need of sulphuring the casks in which the wines are racked, the wine so made being able to stand a good deal more of knocking about and exposure to the air than would be the case otherwise.

(*To be continued.*)

# Dairying.

## NOTES AND NEWS.

THE Minister for Agriculture has approved of Dairy Instructors Pedersen and Hanmer, attached to the Department, giving demonstrations in milk and cream testing before farmers, and holding short evening classes at which farmers or others may attend, with a view to becoming proficient in the testing of milk and cream by the Babcock process. This will give farmers an opportunity of learning, free of charge, how to test the milks of their various cows, as well as the milk and cream which they sell to factories. If only one farmer in every district mastered the question of testing, a decided advantage would be gained. The services of these instructors are always at the disposal of dairy factories and farmers for the purpose of grading cream or giving advice and instruction. Their services are highly valued, especially in districts new to dairying, where their visits in person at the farm-houses for purpose of instruction have been productive of much good. Instructor Pedersen is at present in the southern district, while Instructor Hanmer is in the Glen Innes district.

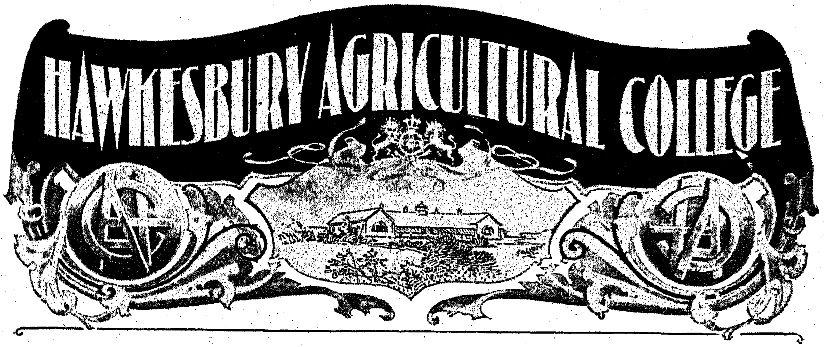
THE Lawrence Kennedy milking machine, which on being first introduced gave such good results, has lost considerably in popularity of late, owing, it is stated, to unsatisfactory work with cows giving a big flow of milk. Three new patents have recently been taken out in Australia in connection with this machine, and those interested are hopeful that the present defects of the machine will be overcome. I have made considerable investigation into the working of the machine, both in Victoria and New South Wales. The results have been varied, and at present the machine is being tried on some heavy milkers on the Berry Government Stud Farm, where exact records are being kept of the cows' yields before and during the period of machine milking. In the Richmond River district, which I visited recently, a good many machines have been installed, but at present many are not being used.

PRACTICALLY speaking, throughout the dairy districts of New South Wales grass is abundant at present. The hay crops also have been good. This, together with the fact that there has been a large number of late calvers, will make butter fairly plentiful in the early part of winter at least, and those who have stored November butter at 11d. per lb. may have some trouble to make the desired profit.

THE storing of butter is rarely to the benefit of the producer. This year the rush to speculate and store has weakened our footing on two good markets, viz., the English and the South African. The Argentine undersold us a penny per lb. in South Africa, and as a result they have captured that market. The English grocer who has been accustomed to buy New South Wales butter for his winter trade has had to make other arrangements, and having lost faith in the reliability of Australian supplies it will take money, which will come out of the producers' pockets, to regain his confidence. To obtain full values for dairy products our supplies must be regular year after year, and if possible, right through the year. On no account should we leave our customers go without some of our butter during every week of the winter butter season in England. We may not be able to send much, but even a very little helps to keep the brand on the market, which goes to show that we make some attempt to keep faith with our customers. I am afraid our Commercial Agents in London and South Africa can do but very little for the New South Wales dairy farmers if some change in tactics is not resorted to. Would it not be possible to form a confederacy of some of our chief co-operative factories, who would agree to ship some butter every year, even though the result may be a slight monetary loss at times? If they would do this they would prevent to a great extent their produce and their trade being buffeted about for the benefit of the selling agent and speculator. The storing of Irish butter by the merchants in days gone by did more to injure the Irish butter trade and give the advantage to the Danes than anything else connected with the Irish dairying industry. What does it matter to the speculative agent whether the farmer gets 7d. or 10d. per lb. for his produce next year so long as he can make his penny or twopence per lb. profit during this season.

---

CATTLE-BREEDING for dairying by the use of pure-bred bulls is engaging considerable attention from Northern River dairy farmers, and in a few years we hope to see the cross-bred sire the exception rather than the rule. The Tweed River farmers were among those who were prepared to give the bulls imported by Government in 1898 a fair trial, despite the adverse comments of interested breeders, and the results have been highly satisfactory. The progeny of these bulls have now taken their place in the dairy, and the farmers speak highly of them as milkers. Every one of them resembles her sire, thereby proving the great ability of these pure-bred animals to beget progeny of their own type. I have seen some nice half-bred Holsteins, Kerries, Red Polls, and Guernseys on the Tweed, but strange as it might seem after the prejudice at first shown against the Kerry breed, the most popular bull among the Tweed farmers is the imported Kerry, "Kildare." When asked how much longer they would require "Kildare" in the district the farmers replied that they would want him as long as he was able to get a calf. The charge for these bulls is £15 per year for 60 cows' service, or £7 10s. for six months for the service of 30 cows. The cross-bred Holsteins should be very suitable cattle for the flat, rich lands on the Tweed and Richmond.—M. A. O'C.



# HAWKESBURY AGRICULTURAL COLLEGE AND EXPERIMENTAL FARM.

## CONSTRUCTION OF PIG-STY BUILDINGS.

By A. BROOKS.

We are told that there is no animal on the farm that is more likely to suffer from colds, caused by lying on damp floors or in draughts, than the pig; and yet there are none that are, as a rule, so carelessly provided for with buildings. Anything seems to be thought good enough for a pig-sty, either in design or construction; and, in fact, few indeed can be said to have any design about them at all. I do not wish to convey to our farmers that I advocate the building of stylish-looking or expensive buildings for the housing of the pigs, but to show that, if they wish to breed for profit, it is necessary to provide proper and suitable housing accommodation.

To spend £10 on building a sty for an animal that will return you £50, or perhaps £100, cannot be said to be throwing away money on buildings, and the sty will be there for the lifetime of a few more pigs of like value. I may be permitted to state here, for the benefit of those who may think that we construct our buildings on a rather more expensive scale than the average farmer can afford to do, that what makes the cost seem so much is the fact that we have to pay the highest market rates for every inch of materials used and for the labour employed in their construction. Anyone who may be fortunately situated in good timber country may be able to erect similar buildings at a very much less cost of cash out of pocket. For many portions of the work, several of our bush timbers split up would make equally good work, and would cost very little in comparison to what we pay for sawn timber here.

### Comparative Designs.

The class of sty usually provided for the pig is placed in a corner of the yard, and consists simply of the posts and rails (round saplings usually) for walls, and a few sheets of bark for covering, but no floor. The trough may be either a half hollow log, with ends nailed on, or a log mortised out of the solid lying in another part of the yard, and half buried in the soil. Now, with such material at hand, if there is plenty of it, a very much better pig-sty could be built if a little thought were given to some design before beginning to construct it. A pig housed in such a place as I have described cannot give as good results for the feed it consumes as another more comfortably housed, and, to the man who is rearing pigs for profit, this should be a serious consideration. The points necessary to be considered in designing pig-sties are to arrange them so that feeding and cleaning may be done with the least possible amount of labour; and, to secure this, we must have good floors, laid with fall towards the feeding troughs, giving good drainage, walls sufficiently strong and high for the class of pig to be housed—boars require higher and stronger walls than sows, the former 4 ft. 6 in. to 6 feet, the latter 3 ft. 6 in. to 4 feet high—and, if possible, the lower portion of the walls should be of such materials that will not injure with wetting. The troughs should be constructed and so placed that the feed can be taken out clean, and that they can be washed out occasionally. The drainage should be conducted as far as possible in open drains, certainly over the building itself, and so shaped that the broom and shovel can be used freely and effectively, and sunlight admitted. The doors of the sties should be ledged and braced, and provided with strong fastenings; the troughs with swinging flaps hanging over the centre, so that the pig can be shut off from them when the feed is being put in, and all ledges and projections should, as far as possible, be avoided on the inside of the sties, so that dirt and water cannot lodge on them, and there will be free scope for the lime-wash brush, which should be used often.

The last, but not the least, necessary feature is that the roof should be high enough to give plenty head room and good ventilation. Nothing is so likely to make a man shun the job of lime-washing or cleaning out a pig-sty, or, in fact, any other building on a farm, more than if he cannot find room enough to stand up in it to do the work.

Now, all these good points can just as easily be embodied in the design of a single pig-sty as they can be in the various buildings required by the man who goes in for pedigree breeding. These may be classed as:—

Sties for boars only.
Sties for sows with suckers.
Sties for sows only.

## For the handy-man.

With the object of helping those who may be able to construct their own buildings, if they are provided with a few explanations and details as to how the work is put together, I have had photographs of the work done on our new boar-house taken as it progressed, from the erection of the first post right to the finish, and they are herein reproduced for illustration.

## Materials to build with.

Undoubtedly, if they could be had at reasonable cost, nothing better could be used than bricks for walls and floors of pig-sties; the next best materials are bricks for floors and timber for the walls. The price at which the materials can be delivered must be the first consideration, together with the cost of the necessary labour, but I should not advise brickwork if the bricks cost more than 35s. per 1,000. I have said bricks for floors in preference to stone and cement-concrete with a top dressing of cement and sand rendering, because, first, the bricks can be put down at less cost, and then they can be repaired much more easily and better, and take much less water to clean off—another big consideration where water is not supplied from a town main. Furthermore, bricks are more easily cleansed than cement. All woodwork for the walls should be hardwood, and if possible the roof should be constructed of pine, so as to make it as light as you can, then you need not cover with corrugated iron, there being several good roof covering materials in the market, such as the P. and B. Ruberoid or Paroid, which as far as I have had experience of them, seem to last well, especially if provided with a close boarding underneath.

Of course as to whether buildings last and wear few or many years depends in the first place as to whether they are substantially constructed, and then whether they are cared for afterwards, by repairing and painting when necessary, instead of allowing them to get into a very bad state before anything is done.

Fig. 1 shows our new boar-house looking south, three of the boars being out for exercise. The ground plan shows the arrangements of the sties, troughs, passage, and exercise yards. This building contains twelve sties, measuring 10 feet clear from front to back, and 8 feet wide, the bedding floors being 4 feet wide at the back wall. The feeding troughs are arranged on each side of the centre passage which is 6 feet wide, and each sty is drained to the passage so that no water can lie on the floors. These drains are constructed so that very little of the drainage is ever visible in them, and they have a fall equal to 1 inch for each sty. All obstructions to the free flow of the drainage are carefully avoided, the doors and walls in the passage being 2 inches clear of the floors.

The floors are laid with brick paving grouted with cement in the joints, and laid with a fall of 4 inches in the length of each sty, the passage floor being rounded 2 inches in the centre, which forms the surface drains at each side. The bedding portion of the floors is laid with 3 inch thick hardwood thoroughly coated with boiling tar, and spiked to bearers set in concrete 4 inches thick underneath (see section of building on page 74.) The walls 12 inches high over the floors are of 4½-inch brickwork set in cement, and over that are constructed with 3-inch thick hardwood framing, filled in with 1-inch thick hardwood upright boards, the full height being 5 feet on outer and 4 ft. 3 in. on inner walls. The boards are fitted in grooves, so that when they shrink (as they are bound to do) they can be closed tightly together and a closing piece put in. The troughs are of brick and cement, and provided with a separate compartment for clean water. This is an experiment which may or may not be beneficial. There are also swinging flaps over the centre of each, and outlets with tapered plugs emptying on to open gutters in passage. The details of this are very clearly shown in the photograph of the passage which is described further on (fig. 13.) The roof is constructed of Oregon timber, rafters being 5 in. x 2 in. set at 34-inch centres, and boarded with ¾-inch boarding, and covered with "Paroid" which makes the roof light and cool. On the north elevation are placed roof lights (three), to admit the morning sun, and to light up the passage. The eaves of the roof are 7 feet high and project 2 ft. 3 in. over the walls to keep out the driving rains. The yards are fenced 4 ft. 6 in. high, with three rails and barb wire on the outside lines, and two rails and split palings bound with hoop iron on the inner lines.

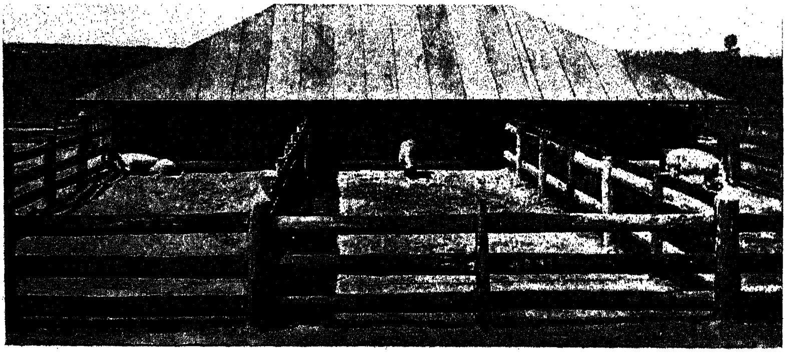


Fig. 1.—Boar house, south elevation.

It will be noted that there are only three yards for the six sties on each side, so that only three of the boars can be let out for exercise, while the others are fastened up. A reference to the fasteners provided on the yard door, will show that neither the boar in the yard nor the one in the sty can manage to open them, so we can give more room to the boar that is out than he would have if we divided the space into six yards, to allow each to be out at any time. The cost of this building may be put down at £130, and fencing another £30 or a little over £13 per sty.

## Site to be selected.

The site will if possible be on a slope, giving perhaps about 1 inch in 10 feet along the length of the building, which should run nearly due east and west. If such a fall can be obtained the building may be erected to follow the slope, which will assist the drains and roof gutters. On the selected site you peg out the full area of the ground plan of the building, and drive a peg about 2 feet clear of the spot where the centre of the corner post at the highest corner of the ground will stand, leaving the top of the peg at floor level.

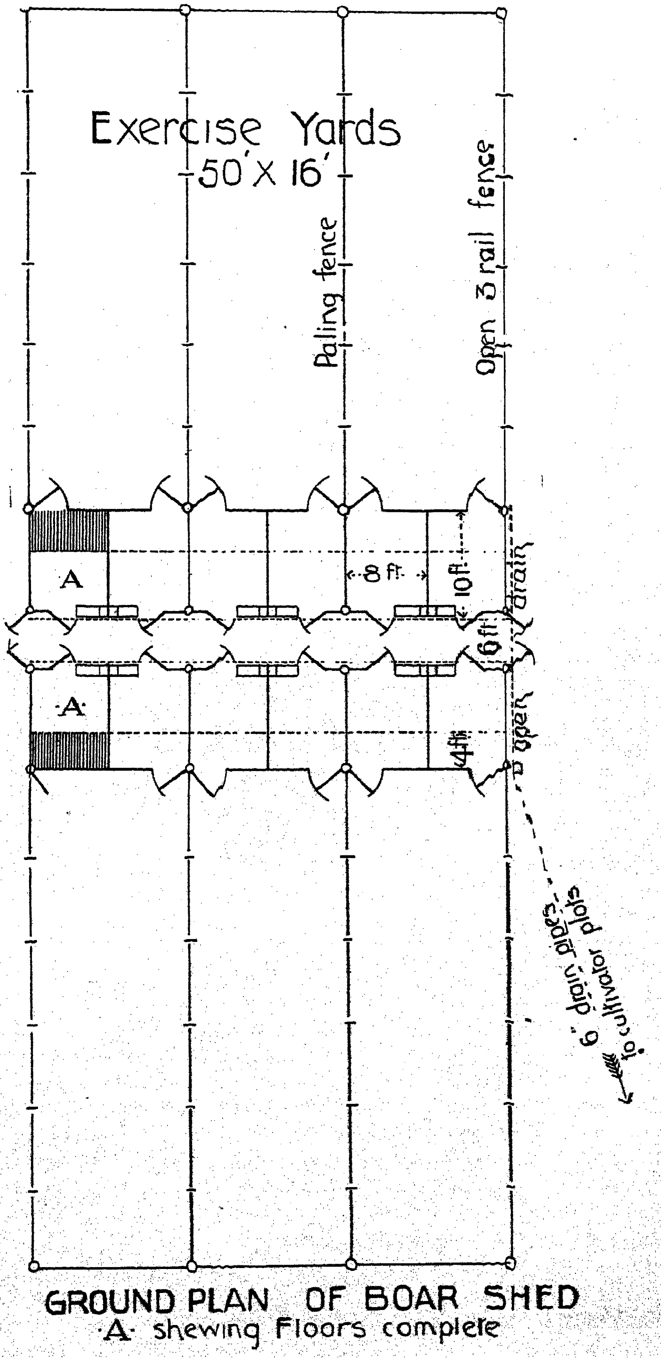


**Fig. 2.** — Boar house, ground plan.

## Preparing the Timbers.

Having your plans to take all measurements from, mark out all mortises, &c., to be put into the posts, and so far prepare them that nothing remains to be done in that way after they are set up. As I have said that this information is principally for those who may be able to build if a little detail and instruction is given, it may not be out of place just to describe how a round post for such a building is prepared and set up. Having decided which end is to go in the ground, you measure down from the top the distance to the floor level and mark with a saw-cut. Then on each end draw plumb and level lines, crossing in the centre of the log (presuming the post to be straight), then with a chalked line strike lines the full length, as may be seen on the posts in the pictures of each stage of the building. These serve to set out all measurements from, and also to set the post upright by. When the chalk lines are struck, take out a blaze mark with the chisel, near the top, and about 12 inches above the floor-level line. This is done in case the chalk lines are obliterated. The hole in the ground to receive the post may be dug out to the distance left on the post, from the floor-level line to the bottom end, which is measured from the top of the peg already driven in.

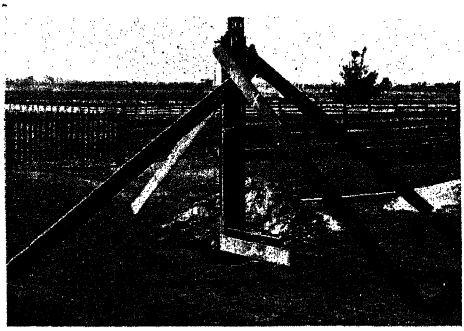


Fig. 3.—Setting the first post.

The use to which all these marks are put will be readily seen on reference to Figs. 3 and 4. The hole having been dug out to the required depth, measured from the top of the peg under H, and the post mortised and otherwise prepared, it is set up, and the temporary stays (X) lightly nailed at the top, and set on the ground. At the top of the post, on each side of P, will be seen a 3-inch nail driven in, from which is hung the lines and plumb-bobs, which may be seen hanging over the hole in the ground below the spirit-level. By sighting the plumb lines and the chalk lines on the post so that they are parallel with each other, the post is placed upright. The proper height is found by levelling from a nail driven in the saw-cut at the floor level, on to the top of the peg, as shown at A-L. The post at the other end is then set in a similar way, and the two set to the proper alignment and fixed.

The photograph and drawing, fig. 4, give a good idea of the construction of the frame of the outer walls. It shows the back wall of two sties, the door openings into yards being on the left and right. The post on the left, at MM, shows the mortises for the rails of the dividing partition wall, as also on the centre square post marked $\substack{\text{C}\\\text{P}}$ at $\substack{\text{PT}\\\text{R}}$ and BR, partition top rail and bottom rail respectively. The upper part of frame, TP, is the top plate that carries the roof, and TR the top rail of the back wall, the space between TP and TR being left open for ventilation over the sties. The distance from the underside of BR to the ground is built up in 4½-inch brickwork in cement mortar. This portion of the walls is the same throughout, and is done after the whole of the woodwork is completed, so that all jarring which might cause cracks in the brickwork is avoided. On the round post, at the top mortise M, will be seen the galvanised flat iron T square used for marking out the mortises on the round timber. The centre line through the square is laid on the chalk line of the post, so that the mortise can be marked out at right angles. The whole frame between the door posts, DP, is made and set up in one piece, and secured to the top plate with ½-inch bolts, the bottom ends being temporarily fixed in position until the brickwork is put round them.

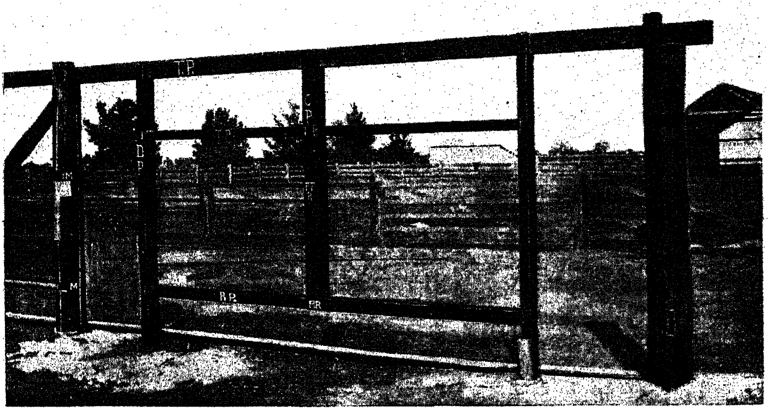
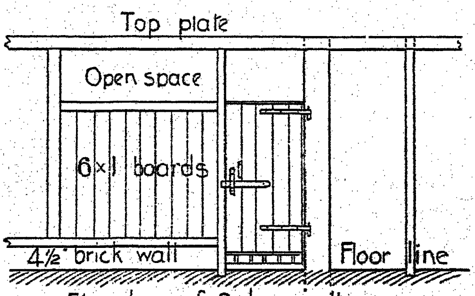


Fig. 4.—Plate showing framework of outer walls and elevation of outer walls.



Elevation of Outer walls

Fig. 5, again, shows the setting of the framework at one end of the building, with passage opening in centre. Here, again, may be seen the use of the lines struck on the round posts, as to place them in their respective positions exactly it is necessary to mark out a rod or board, as may be seen on the ground, with the broad-arrow (↑) marks at each post line. These marks are at the distances from centre to centre of each post, so that they only require to be upright with their centre lines to each mark on the rod when they are in position. The top plate having been prepared to fix, and the lengths of the top rail, TR, and ledge, L, measured off into the mortises of the posts, the whole frame is ready to fix together. On the left-hand panel of the frame may be seen the twitch rope, used as a cramp to pull the posts together before bolting and nailing up. On the ground may be seen various rails, &c., prepared ready for fixing.

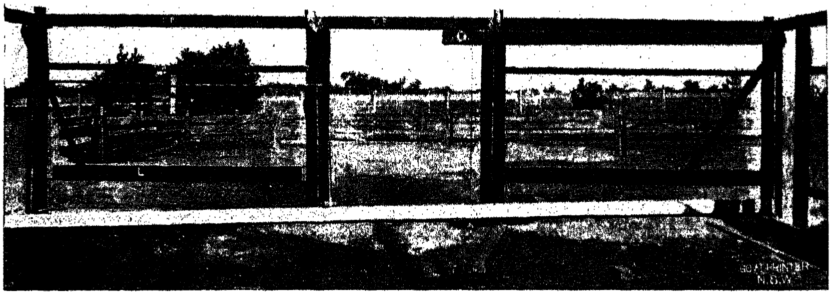


**Fig. 5.—Showing framework across end of building.**

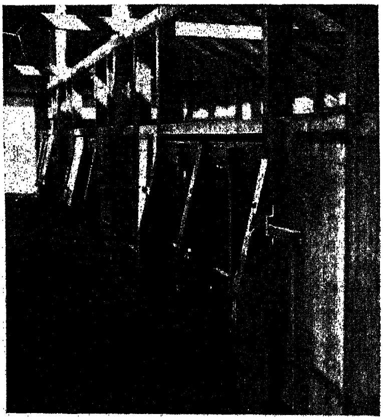


**Fig. 6.—Framework of the passage walls at troughs.**

This illustration shows very clearly the construction of the framing of the passage walls, the openings for the troughs being at AA. Note the temporary brick pier placed under the bottom rail of the dividing wall where it lies on the division of the trough. The pegs shown over the letters A are the stops for the flaps when they are pulled over the outside of troughs.

Fig. 7 the same in elevation, the left-hand side being of one sty completed, with the door and flap in position, while on the right the flap is removed, and the door ledges only are shown, to further illustrate the construction.

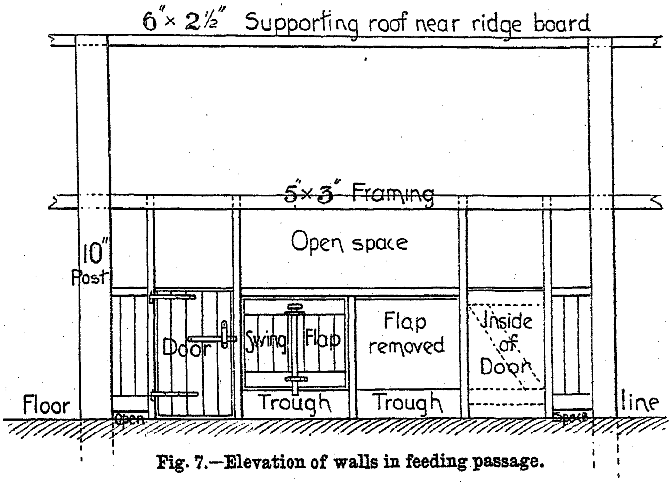


Fig. 7.—Elevation of walls in feeding passage.

Fig. 8 shows the way to build the woodwork at the ends of the troughs in each doorway, the pieces cut to shape being bolted to the door stud as shown at their top ends, the bottom ends being simply spiked, and to be further secured in the floors when brickwork is being done. AA shows the position of the flap stops.

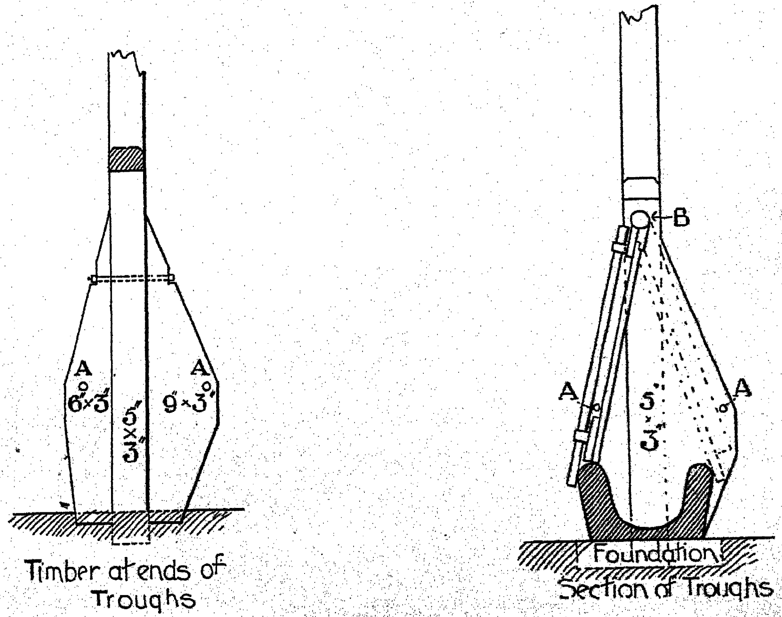


Fig. 8.—Elevation at ends of troughs.

At each partition wall where it crosses and rests on the trough the tapered piece is spiked to the framing at the small end, the bottom being secured with a flat iron strap as shown. The iron strap A. shown going down into the floor is on both sides of the wall, and bolted through the bottom plate; they are for the purpose of keeping the partition secure against a side thrust, which would fracture the trough.

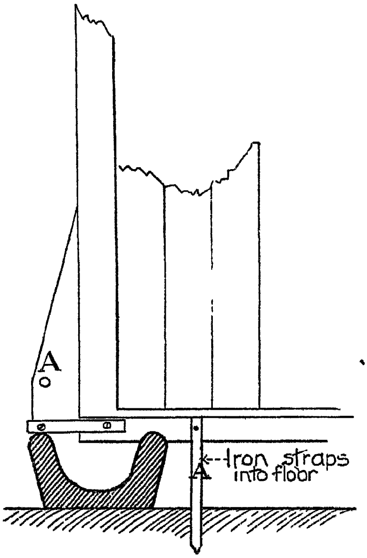


**Fig. 9.—Partition through troughs.**

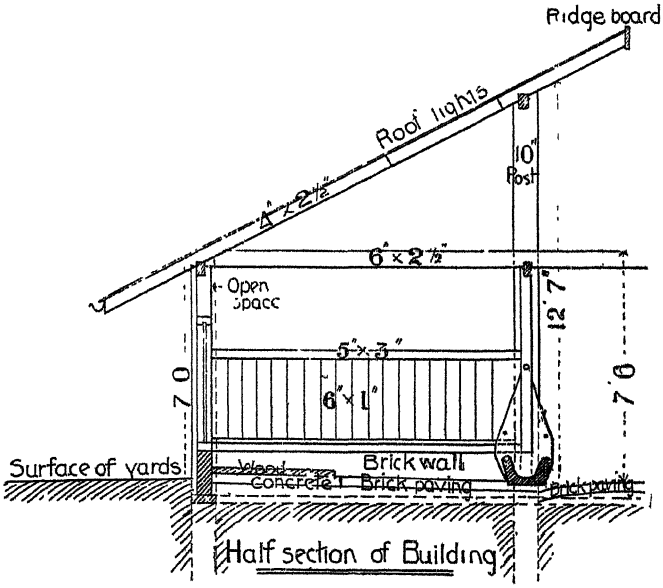


**Fig. 10.—Half section of building here.**

Fig. 10 represents the construction of the building throughout in section. The 4½-inch brick walls up to the top of the troughs, with the 5 inch x 3 inch bottom rails of framing resting on them. At the back walls will be seen the 4 inch x 3 inch bedding-floors laid on concrete 4 inches thick, and draining on to front floors of brick paving set in cement. The passage floor rounded in the centre, and the outer edges butting against the front edges of the sty floors at 2 inches below the top of them forms the gutters. This confines the drainage to the sharp angle thus formed, so that the drainage is not in the way of one's feet when looking into the sties. The roof is as shown—lofty, and overhanging at the eaves sufficient to shelter the walls.

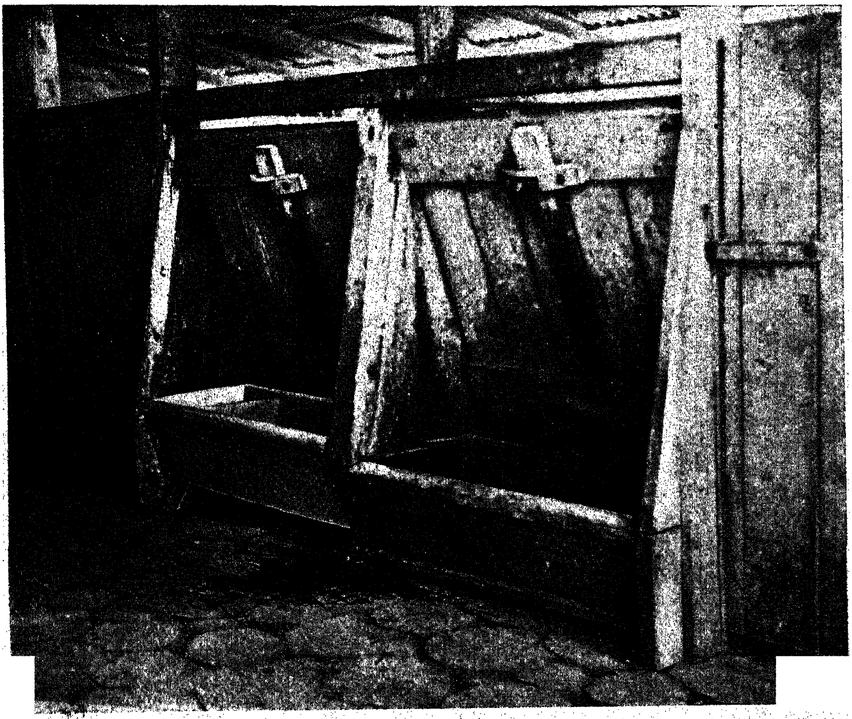


Fig. 11.—Troughs.

There are many so-called troughs to be seen in use for feeding and watering pigs; but few can be said to fulfil the conditions that have been stated, viz., that the food can be easily and cleanly removed and the trough properly cleaned or washed out. The latter is almost impossible if the trough is a fixture, so I have designed a tilting trough, as shown on the left of the above illustration. Allowing that the drain is formed in the passage floor, as in our boar-house, the trough when in position would be 1½ inches clear of the floor of sty to allow all water to pass underneath and fall into the drain. Then, when it has to be washed out, it is tilted up and outwards, as shown in fig. 12, and empties itself into the drain again. It does not cost more than a brick and cement trough if made of heavy galvanised iron, and could be made out of a half hollow log or an oil drum. The trough is simply provided with two pivots on the front edge, and these work in holes bored into the side framing, much the same as the flaps over them. If made of galvanized iron, as shown in Figs. 11 and 12, then the construction is as follows :—Made to the shape shown

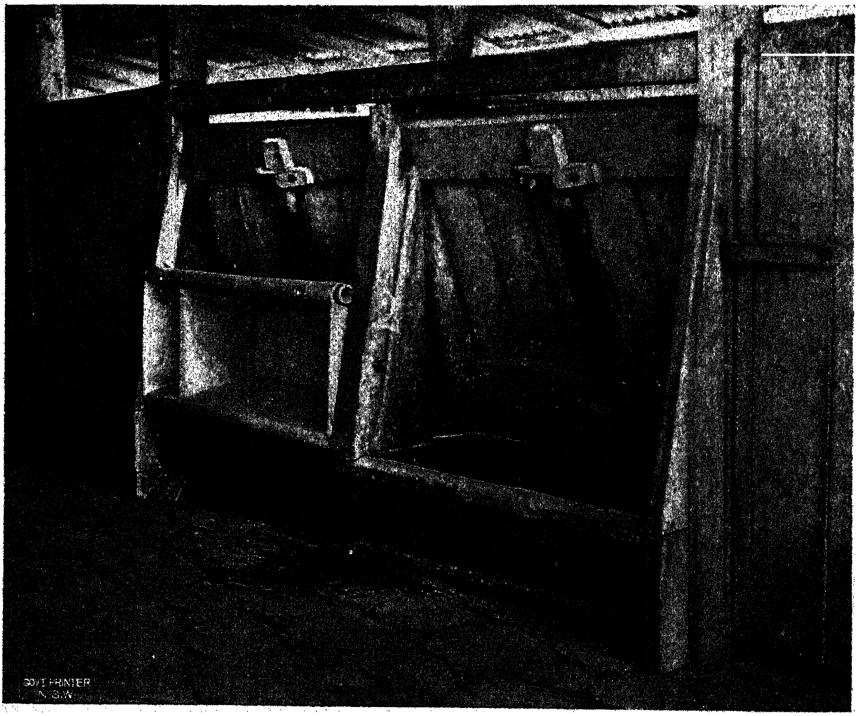


**Fig. 12.—Trough tilted for cleansing.**

with 20 gauge iron, with rolls on both top edges to take 1 inch water piping, two pieces about 9 inches long being fixed in the front roll, and left projecting 1 inch for the pivots; then two other pieces, similar length, fitted with short stud pins (*see* front of upper edge in Fig. 12, which stand out through two short slots in the roll on the trough. These act like sliding bolts to secure the trough when set for feeding. If made of heavier material, such as the log, no fastenings would be required. Two bearers, 1½ inches thick, under the ends serve to support the weight off the pivots.

The troughs for boars require to be of a most substantial kind, and I made them fixtures. They are built of bricks on edge set in cement, the partition, P, being of bricks split in halves, also set in cement, and the whole, out and in side, finished smooth with cement plaster, gauged in proportions of two parts washed sand to one part cement. The top edges are rounded over, the bottoms inside being half round, and each have waste plugs opening out on to gutter in front. FW, on front of trough, shows the two separate troughs for food and water. The end of the flap-fastener which secures the flap to the trough is marked X.

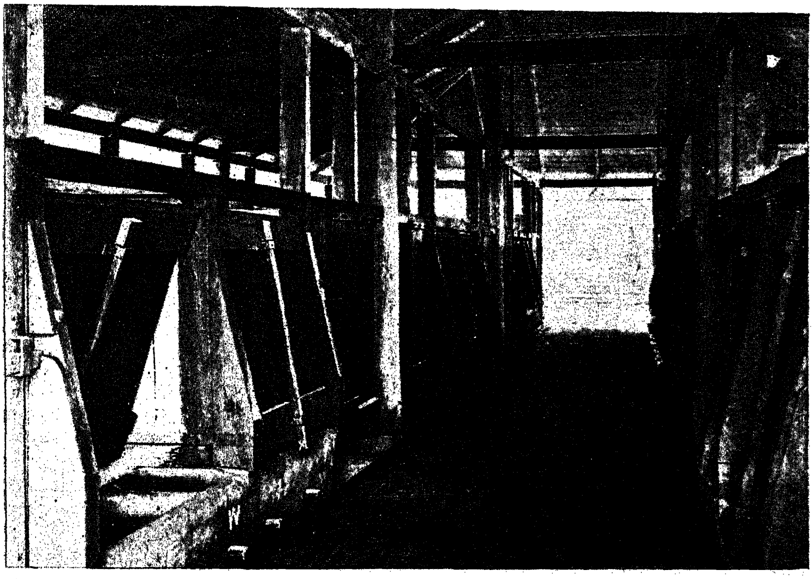


Fig. 13.—Finished passage-way, showing troughs and doors of boar-house.

## Door and Fasteners.

The doors for pig-sties (especially for boars) require to be strongly made and securely hinged and fastened, so that they cannot be lifted up when closed.

Ledge doors, braced and carefully put together, hinged with 1½ inch x ¼ inch hook and eye hinges, are all that is necessary. The fasteners may be on the "Norfolk latch" principle, as shown in the illustrations. For the outer doors leading into the yards, a further precaution must be taken against the chance of the boar that is in the yard opening the door of the next sty, which is in the same yard. The drop-catch, marked C, hanging over the fastener F (Fig. 14), does the job very simply. It is hanging loosely on a ¼-inch bolt, and would require a very artful pig to know how to use it.

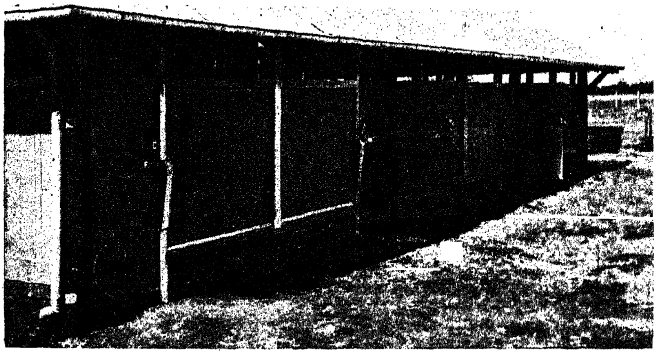


Fig. 14.—Outer doors and fasteners.

When it is placed as shown, on the end door at the left of the fig. 14, the door is secure. By throwing them round into the position shown on the other doors, the latch-bar can be raised with one hand.

## Other Styles of Sties.

I have here given as briefly as could be, consistently with my object to make everything plain to those who might wish to make use of the information, a detailed description of our new and up-to-date boar-house, which is much admired by all interested in pig breeding who visit here.

Sties for sows with young ones may be of similar construction as far as the class of materials to be used and the general design are concerned; but the size of each sty should be increased to 12 feet x 10 feet. The floors for bedding on may be of portable batten frames nailed to ledges 4 inches x 1 inch, 4 feet long, and the battens fixed at ½-inch spaces. These can be lifted and laid aside while the sty is

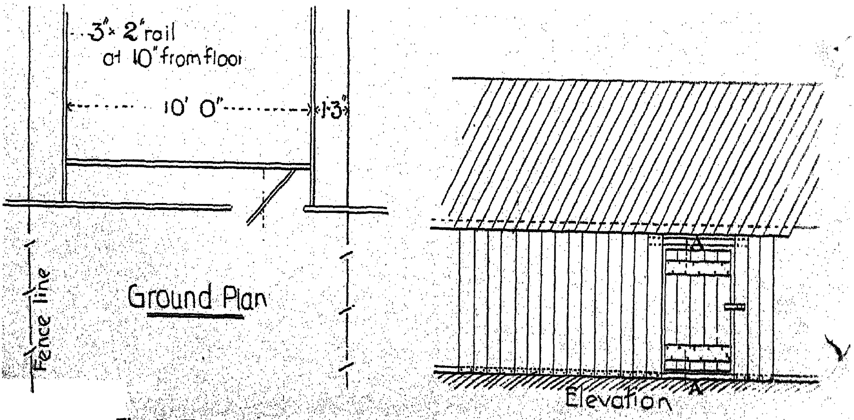


Fig. 15.—Elevation of back wall and part ground plan of sty for sow with suckers.

being cleaned up. There should also be fixed around the side and back walls a guard-rail of 3 x 2 hardwood on edge, supported on short studs where necessary, and at 10 inches clear off the floor. (*See* ground plan, fig. 15.)

This is a prevention against the youngsters being crushed when the mother throws herself down near the wall. Then in the back wall leading into the yard the door should be hung on pivots, so placed that unless the fastening button is swung round, the door will open only sufficient to allow the little ones to pass through. On the ground plan the door is shown in this position by the solid line, the dotted line at right angles to the wall being the position when opened full.

The walls for these styes need not be more than 4 ft. high. Sties for sows only may be arranged separately in yards of about 1 chain x ½ chain. The building may be as here shown.

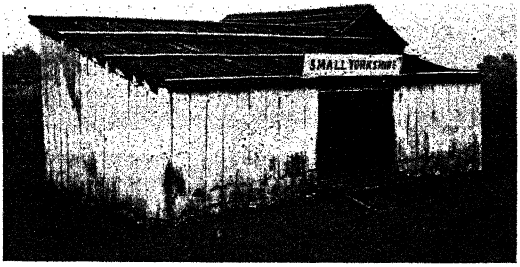


Fig. 16.—"Small Yorkshire" sty.

This sty is 16 ft. x 9 ft. on the floor, and is built almost entirely of fence rails, with saplings for rafters, and 4 in. x 2½ in. sawn stuff to take the bark covering. The floor slabs are fixed at each end to the sill pieces, on which the bottom ends of the wall slabs are spiked.

The materials for such a building as this cost £6 10s., while the labour to erect costs £2 10s., and it will accommodate six sows. Although it is a more comfortable shelter for sows than most cheap constructions, it is very far from being a good healthy stye, as it has not a good floor, which is the most necessary part to make good, if the drainage is to be carried away. With the open slab floor, the stye has always an offensive smell, and except that the pigs may have a dry bed, they would be better styes without the slabs for a floor altogether. To improve this a sloping floor of brick or concrete would have to be put down under the slabs, which should, in such a case, be about 12 in. above the cement, the walls being open all round this space for ventilation and to permit of cleaning out. The cost of laying brick-paved flooring may be put at 3s. 9d. per square yard, while concrete cemented over and 4 in. thick will cost about 5s., so that for 16 ft. x 9 ft. the cost would be from £3 to £4. Then the feeding troughs have to be put down, which, of course, should be portable. As to how long this building will last, constructed in the manner described, one has only to look at the ground line on the illustration to see that the wall slabs are already rotting away. Then again, it is one of those sort of buildings that you get your head bumped a few times in, when you go to limewash the inside.

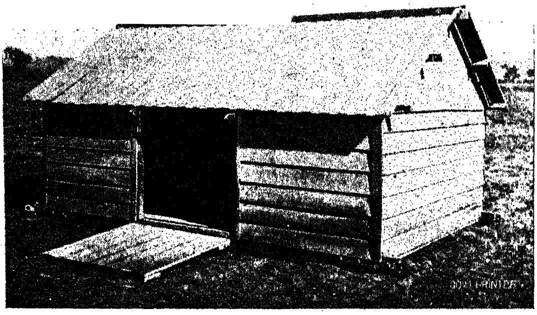


Fig. 17.—Portable pig-house.

The question is, would not such houses, from a sanitary point of view, be better if made movable, as the one here shown? This house 12 ft. x 8 ft., built of sawn timber, costing £5, will comfortably house a dozen pigs, and can be used on paddocks in which crops have been grown, especially for pig feed. It will be seen that the two side sleepers or slides, which are 8 in. x 3 in., are the only heavy pieces of timber in the whole job, all the remainder being from 4 in. x 2½ in. to 6 in. x ½ in. and 3 in. x 1 in. The walls are boarded with pine weatherboards, the roof is double thickness of 6 in. x ½ in. boards, spaced and lapped, giving ventilation at the top. The floor is of 3 in. x 1 in. pine battens, spaced ⅜ in. between. The flap door is used for the double purpose of a gangway when set in position, and to shut the pigs in when required to keep them in, or to move them to another

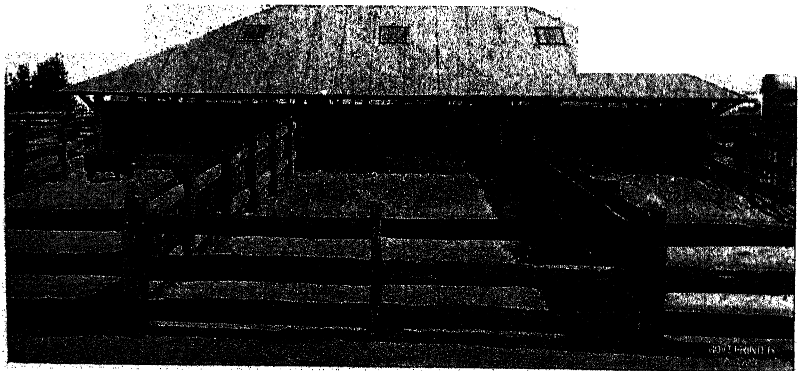


Fig. 18.—North elevation of new boar-house.

position. Drag irons are provided at either end to hook the horse to. It makes a very convenient and comfortable shelter for pigs, and can be constructed for £9, including painting on the outside, which should be renewed say once a year to keep the timbers from perishing. There is not the slightest doubt but that pigs provided with double runs, that is, to have them on fresh grounds, say every two or three weeks, do much better than those that are on the same ground all the time, and with portable houses this would be much easier managed.

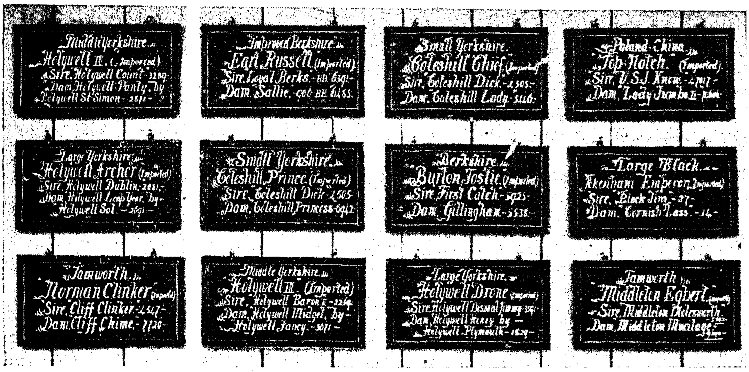


Fig. 19.—Plate of pedigree boards underneath.

Figs. 18 and 19 show the north elevation, and the names and pedigrees of the twelve occupants of our new boar-house.

## HAWKESBURY DISTRICT FARM NOTES.

H. W. POTTS.

DECEMBER brought some desirable changes in the weather, and the new year is ushered in with more favourable conditions than any of its predecessors for many years past. Only a month ago we had to record the prevalence of unusual heat and absence of adequate moisture which led to the indulgence of gloomy forebodings. Now we may congratulate ourselves on the falsity of the forecast. The genial persistent rains in December, totalling 5 inches and well distributed, combined with a warm soil and atmosphere, provide conditions eminently suitable for growth of the most favourable character. The effect so far has been remarkable. It is practically a second spring.

The early summer crops have benefited to the fullest extent. Grazing paddocks are providing a maximum of fodder. Maize, millet, sorghum, cow-peas, potatoes, lucerne, squashes, pumpkins and other crops could not look better.

The outlook now, happily, is such as to transfer the farmer's position from one of doubt to that of comparative certainty in making provision for the winter's requirements as well as a profitable return for market.

The rain arrived in the nick of time, and it would be difficult to compute its value after the series of singularly dry seasons we have experienced.

*Maize.*—The standard crop is yearly becoming better recognised as a true forage crop apart from its usefulness in providing corn. There is a real scope in testing its capabilities as a green fodder for sheep either alone or in combination with other fodders, such as rape, cow-peas, or vetches. The latter may follow a cereal crop, particularly where the land needs clearing, or after hay, pasture, rape, or roots. As a main forage crop, we have found maize especially serviceable for ensilage. The early crops are "tasseling" throughout and promise to yield excellent results as corn. It will be advisable to allow it to ripen and prepare other ground for quick-growing ensilage crops. With the late rains stock are amply provided with good pasturage for several weeks to come, so that the greater portion of all green crops may be reserved for conservation. The early varieties of maize most suitable to this district for ensilage are Early Mastodon, Clarke's Mastodon, or Hickory King. The sowing of maize and sorghum may be followed up vigorously throughout this month. Moisture and warmth are both assured for good returns. The amount of seed to sow depends largely on the character of the soil, and also on the use the crop will be put to; further, the kind or variety influences quantity again if the maize is to be sown with the crops. Where the soil is poor, a thicker seeding is necessary. The same applies where forage crops are wanted rather than grain returns. Where a large seed kernel is selected, a larger seeding will be found best. The varieties needed to provide a dense foliage should be more sparingly sown than those of a different habit. When maize is sown broadcast and alone, the quantity may vary from one to three bushels per acre. When sown with cow-peas, equal quantities will be found sufficient in most soils. Two parts corn to one part hairy vetch has been found in America to yield a prolific forage crop; also an admixture of maize, vetches, and Dwarf Essex Rape (2 to 3 lb. of seed to the acre) has given good results.

*Sorghum.*—In many districts the straw crops have proved failures, and one of our main substitutes is sorghum. This month advantage should be taken of the suitable prevailing conditions to sow sufficient sorghum to lay in a stock of winter green-stuff and ensilage. It will yield from 7 to 12 tons per acre, and furnish an excellent succulent and palatable fodder for all classes of stock, particularly cattle, pigs, and sheep, and as a dried food in the form of sorghum hay for horses. The Early Amber Cane, Planter's Friend, and Imphee invariably give good results. The first named is a great producer of forage, has a high sugar-content, matures early, withstands dry weather after becoming well established, and will resist drought even better than maize. It feeds more deeply, and hence will thrive on land too poor to raise maize crops. Sorghums flourish best on free working, moist, sandy loams. Seed will germinate rapidly this month. The young plants are delicate, and require shallow cultivation until well grown.

*Millets.*—For hay and green crops, millets may be sown this month to advantage. White French, Hungarian, and Broom Millets are the best varieties.

*Potatoes.*—The early potato crop has been subjected to the vagaries of the season, and the yield is not by any means satisfactory. The second or late crop may be planted about the middle of the month, should the prevailing weather conditions continue. Medium-sized whole potatoes are the best to use, rather than cut ones for sets, as the latter are liable to develop dry rot. It is best to plant only those potatoes which have sprouted.

*Sweet Potatoes.*—Plants may still be set out as they become available. The early planted crops should now be fit to dig, but, in any case, they are quite safe left in the ground to grow until wanted.

*Pumpkins, Squashes, and Melons.*—These crops have responded in a marked degree to the recent rains, and it has been a difficult task to keep down the weeds in consequence until the vines have secured possession of the ground. In these crops we have a further stand-by as food for cattle and pigs. Bush squashes or marrows may still be planted. The custard varieties are again demonstrating their value this season as especially early maturing growers and good croppers. Two months after planting they are ready for the table. Owing to their greedy disposition they utilise liberal dressings of famryard manure. They are compact in their habit of growth, and hence can be planted quite close—6 feet apart.

*Swedes and Mangolds.*—Towards the end of the month early sowings of these root crops may be made with advantage. Get the ground into fine tilth, and when sowing add a small proportion of superphosphate to assist the young plant over a critical period.

*Lucerne.*—There exists no food crop for stock so certain and prolific as lucerne. Yearly it is becoming more popular, and gives unmistakable evidence of its importance. It can be grown with more or less success on all classes of soils, and well repays for cultivation before sowing. The seed bed should be prepared towards the end of this month, to be in readiness for sowing immediately after rainfall. It is best to follow crops intended to clean the land or fallow. Plough deeply, and if possible subsoil. A clean, fine, well-cultivated soil is needed to get the full benefit of a sturdy growth.

*Paspalum Dilatatum.*—The value of this grass as a drought-resistant summer fodder, after our recent experience, is fully established. Root propagation is best, and to this end it is good practice to prepare the land for early autumn planting now, taking care to get it fairly clean by sound cultivation.

# Farm Notes.

## BATHURST DISTRICT.—JANUARY, 1903.

R. W. PEACOCK.

THE frequent showers of the last few weeks give promise of a favourable summer, and should prove a stimulus to farmers to attempt the growth of the various crops suitable for hay-making and green fodder. Owing to the exceptionally severe season the wheat and oat crops in this district well-nigh failed, resulting in a considerable shortage.

Now that harvesting is practically completed, attention should be given to the growth of suitable crops to make good the deficiency as far as possible. There are many crops available for autumn cultivation suitable to the various requirements, and although in ordinary practice it may not be wise to attempt to raise in succession two allied crops from the same land during the same season, yet under the present unusual circumstances it will be just as well to take every advantage of the favourable conditions to provide for winter fodder requirements.

Wheat, oats, barley, rye, millets, sorghum, and maize practically require similar foods. It may therefore be expecting too much of the soil to produce another cereal crop after a successful catch-crop of those already mentioned. Land which has been fallowed or has produced an early potato or leguminous crop would be most suitable for such autumn crops. The choice of soils suitable to the various crops goes far towards success.

The sorghums and millets require similar land to maize, and should be in good heart to give satisfactory results.

Barleys for green fodder require a soil with a fair proportion of available food near the surface. Ryes will thrive upon much poorer and lighter soils than any of the former, and are for this reason valuable; they yield their best crops upon good wheat soils.

*Maize and Sorghums.*—These can be sown largely during the month for green fodder and ensilage. They require good cultivation during their earlier stages. This can be done expeditiously with the common harrow. Many farmers are afraid to use the harrows over growing crops, but when used with discretion the practice is most profitable, especially to break the crust after rainfall.

*Millets.*—These can be sown freely for green fodder, ensilage, or hay. The Hungarian is most suitable for making hay, and should be cut just after the ears appear. If left too long it becomes harsh and woody and loses value for this purpose. Broom millet also grows well and makes good fodder. There are other good varieties, but the seed is not obtainable in quantity.

*Barleys.*—A small area should be sown for green fodder towards the end of the month, to be supplemented by others throughout February. The skinless and Cape varieties are the most suitable. They are valuable on account of their resistance to frosts and because they remain green throughout the winter after the sorghums and millets have been killed.

*Ryes.*—Should also be sown as advised for barleys, and possess the advantage of producing fair yields upon the poorer soils; they also withstand greater degrees of cold than other cereals. The Emerald and Black Winter are suitable varieties.

*Potatoes.*—If not already planted, a few may be put in during this month. Those sown earlier will require frequent cultivations to kill the weeds and conserve moisture. Potatoes are very sensitive to any check throughout their growth, and unless steps are taken, by means of good cultivation, to ensure steady, uninterrupted growth, the yield will be seriously affected.

*Swede Turnips.*—Should be planted largely in well prepared soil. They possess the advantage of being easily stored for winter use. The larger varieties should be sown in drills about 2 feet apart and thinned out to about 1 foot in the rows.

*Rape.*—Can be sown largely this month. It is an excellent sheep fodder, and fills an important place in the series of crops that can be sown in rotation with the twofold object of providing for the fattening of the farm sheep and improving the land, both as regards texture and fertility for the winter-sown cereals. All summer crops should be kept cultivated to kill weeds and conserve moisture. As much land as possible should be ploughed for the cereal crops in order that it may be in readiness for early sowing. Land required for lucerne and other permanent crops should be kept free from weeds and worked thoroughly.

## RIVERINA DISTRICT.—February.

G. M. McKEOWN.

As January is one of the hottest and driest months in the year, field and garden operations will be limited to the care of growing crops by frequent tillage and the application of water where it is available.

Pumpkin, squash, and melon vines should be pinched back to ensure greater fruitfulness, and where high winds prevail it will be found advantageous to peg down the vines at intervals to prevent them from becoming matted and twisted together.

Should serviceable rains fall during the month the opportunity should be availed of to sow a quick-growing crop, such as Hungarian millet for green fodder or hay. This crop occupies the ground for about three months only. Land should be prepared where the conditions will allow, for the early sowing of rape and swedes for sheep-feeding.

Land fallowed for sowing cereals should be scarified or harrowed to conserve moisture, and to improve the condition of the soil for early sowing.

# Orchard Notes

W. J. ALLEN.

## JANUARY.

In those districts where irrigation is practised it will be well to give everything a thorough good soaking this month, being careful to cultivate the land well immediately it is dry enough to do so. On no account allow the soil to become hard and baked after a watering, else it will dry out and crack, and will require another watering within a very short time, nothing that the grower can do to his trees being more detrimental to their welfare than the continual flooding and baking of the soil.

Over most parts of the State where irrigation is not practised we have had exceptionally good rains, and as a result the prospects for a good fruit harvest never looked brighter. In some places the trees have not set heavy crops, but owing to the favourable growing season the quality of the fruit should be of a higher standard than we have had for many years.

The month of January is a favourable time for fighting the enemies of our citrus trees, and the fumigating tents and spray pumps should be kept steadily going; but care must be taken not to fumigate on a very hot day, but rather do the work on cool days, or at night, so as to avoid injuring the trees. If it is found that the dose given does not kill all the scale, a slight increase may be made in the quantity of chemicals. In taking the measurements of the trees after tents have been placed over them, the operator must be careful to take the extreme height and width outside, then by referring to the fumigating table, which I compiled some time back, the quantity of chemicals required for a tree of the dimensions so measured can be easily found.

It will be found advantageous to thin out some of the shoots on all young trees where they are found growing too thickly. These may be either cut back to within two or three buds of the main arm, until the branches are so distributed as to be sufficiently far enough apart to enable the wood to mature properly by the fall, or, if growing too thickly, it may be removed altogether.

Apple-trees which show a tendency to grow too much wood in place of throwing out fruit spurs may with advantage receive a summer pruning.

Towards the end of the month worthless trees may be budded to better varieties.

Bandages on apple and pear trees should be watched closely, and all grubs removed from same and destroyed at least every ten days. All fallen fruit should be picked up at least twice a week, and either fed immediately to pigs, or boiled, so that the grubs of the Codlin moth will not escape.

I would deem it a favour if any growers of peaches or nectarines who have sprayed their trees with the lime, sulphur, and salt solution each year would advise me as to whether they have had any peach leaf curl on such trees since adopting this treatment.

I would recommend all orchardists to keep a close lookout for diseases on the fruit and trees, and wherever anything suspicious is found, forward samples to the Department of Agriculture, so that they may be advised how best to get rid of them. If a tree is not doing well, or is dying back, there is always some reason, it may be lack of drainage, or the attacks of one of the many diseases to which our fruit-trees are liable, but whatever the cause there must be a remedy, and in order to keep the orchard as clean and healthy as possible, the grower must be on the alert, and, as soon as trees show signs of distress, ascertain the cause and remedy.

## GREEN FOOD FOR FARM HORSES.

A WRITER in the *Live Stock Journal*, in discussing the merits of a green fodder dietary for horses says:—"Though not a suitable food for light horses required to do fast work, and to be in hard condition, the various green fodder crops are a very valuable food for farm horses, and as large a use for this purpose should be made of them as the available supply allows of. By feeding plenty of greenstuff, a considerable reduction of the cost of keep of the team horses is effected.

"As all green forage cut in a young state is comparatively rich in albumenoids, allowance should be made for this in providing concentrated food stuffs when the horses are fed on greenstuff, if it is desired to feed as economically as possible. For instance, it would be a wasteful proceeding to feed beans (which are very rich in albumenoids) when large quantities of green forage are supplied. Oats also may be dispensed with, either wholly or partly, and maize substituted instead.

"Owing to its carbonaceous character, maize is especially suited as a concentrated food for horses fed largely on green forage, these two food stuffs balancing one another in regard to the proportion of the various food constituents. A satisfactory and economical albumenoid ratio is thus obtained.

"When commencing to green-feed horses, they should gradually be accustomed to the new diet in order to prevent digestive disturbances. Though individual horses differ very much in the way they are affected by a sudden change from dry food to large quantities of succulent green forage, and some do not experience any marked disturbance of the digestive system, yet it is best to be on the safe side and run no risks. Accordingly, only small portions of green food should be given at first, which should be gradually and daily increased until the maximum allowance is reached. The ration of hay should be gradually reduced in the same manner.

"The amount of green food to be given daily depends chiefly on the quantity of green-soiling crops which are available. The limit of green food consumed daily by a farm horse may roughly be put at one hundredweight. It is advisable not to omit the feeding of hay altogether, and a small quantity should be given unless hay is very scarce on the farm. The best way to feed it is by chaffing it, and mixing it with the corn.

"With a diet of green food in fairly large quantities, the condition of the horses cannot be expected to be as good and as hard as it is when they are fed on dry food, and they are in consequence more liable to perspire. Their wind also is impaired somewhat after they have eaten any quantity of green forage, owing to its bulky nature. As farm horses are not required to work at fast paces, these drawbacks of the green-soiling system are of little importance in their case, and more than counterbalanced by its attendant advantages.

"The green food may be fed either in a long state, or it may be chaffed and mixed with straw chaff. This last mode of feeding is to be recommended at the commencement of green-soiling, as it facilitates the change from food of a dry nature to the succulent food, and largely obviates the digestive disturbances which may otherwise take place.

"In chaffing the green food, too large quantities must not be chaffed at one time, as, if it is not used up within a reasonable time, fermentation is set up, which readily goes so far as to be injurious to horses.

"Whilst the horses are being fed on greenstuff the dung is naturally of a more or less loose character, and during the first stage actual diarrhœa is often present. The addition of 2 or 3 lbs. of dry, coarse bran is very useful, as dry bran—contrary to the property possessed by bran mashes—is slightly astringent in its action on the bowels.

"Bran mashes are quite out of place, and wholly superfluous during the time the horses are receiving green forage, although they are exceedingly useful in the stable, when the diet is of a dry nature.

"In feeding the corn, care should be taken that it is not given immediately prior to the green food, as in this case it will leave the stomach before it has undergone thorough gastric digestion, with a consequent waste of food constituents. It is best to give the corn after the horses have eaten their allowance of green forage.

"All kinds of green forage crops may suitably be fed to horses. The two best kinds undoubtedly are lucerne and sainfoin, which cannot be surpassed by any other forage crop, as far as the suitability as a food for horses is concerned. Apart from their value in this respect, lucerne and sainfoin possess qualities in regard to their habits of growth which make them extremely valuable where the soil and climate are favourable to their being grown."

# Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

## DIRECTIONS FOR THE MONTH OF JANUARY.

### Vegetables.

As the drought seems to have broken up at last, attempts will, no doubt, be made to grow vegetables again in parts of New South Wales where for some time past it was not possible. At the time of writing, rains have fallen nearly all over the State, and it is not unlikely that during January there will be still heavier falls. It will be safe then to plant and sow all seasonable vegetables.

*Beans, French or Kidney, Lima, Snake, Butter,* and every kind and variety of this tender class may be sown extensively almost everywhere, and if the soil is moist and the sun warm, the plants will grow very quickly and produce beans.

*Beet, Silver.*—If planted out now from the seed-bed, this useful vegetable should produce leaves fit for use very soon; but the ground should be heavily manured with farmyard dung. Sow a small quantity of seed, once or twice during the month, for planting out when the seedlings are large enough. Very little will suffice, especially if a variety of vegetables is grown.

*Beet, Red.*—Sow a little seed of the globe variety, as well as of the long-rooted kinds. Thin out the plants well as soon as they are two or three inches in height.

*Cauliflower.*—It is always worth while making an attempt to grow a few cauliflowers, and if any plants are ready they should be set out, say a few once a week or once a fortnight, if the soil is in a favourable condition. Use abundance of farmyard manure when digging up the ground. A little seed may be sown occasionally during the month.

*Cabbage.*—Sow a little seed occasionally, and plant out a few strong plants now and then.

*Celery.*—Sow a little seed and plant out a few seedlings which are sufficiently advanced. Celery needs a considerable amount of water, and also abundance of rich manure.

*Carrots.*—Sow a little seed from time to time, and when the seedlings come up keep them quite free of weeds, and thin out well. Do not use manure, unless unavoidable, but sow the seed where manure was applied in good quantity for some vegetable which has been removed.

*Kohl Rabi.*—Sow a little seed either in seed-bed or in rows where the plants are to grow.

*Lettuce.*—Sow a row or two occasionally in the bed where the plants are to grow, for transplanted lettuces, during the summer, frequently bolt to seed, whilst those sown without transplanting are not nearly so liable to run. Thin out the seedlings when 3 or 4 inches in height, and mulch the remaining plants.

*Maize, Sweet.*—In warm, moist places, a little seed might be sown.

*Peas.*—In the cool districts, sow a row or two from time to time during the month.

*Potato.*—Manure some ground with farmyard manure, and plant a few rows of the Kidney varieties. Sow nothing but clean seed and look out sharply for scab.

*Radish.*—Sow enough seed to keep up a continuous supply, and use the radishes whilst they are quite young and tender.

*Tomato.*—In gardens where the rainfall has been satisfactory, tomatoes should be abundant, and it is frequently the case that they are so abundant that many are allowed to rot under the plants. This is a mistake, and likely to assist in spreading some of the tomato diseases. Clear away all fruit which shows indications of rotting, and destroy it. If plants have lately been raised in a seed-bed, they can be planted out at any time if the weather be favourable.

## Flowers.

A FLOWER garden which may have been ruined by the drought can very soon be made pretty and satisfactory again after the rain if a stock of plants be available, or if seeds of some quick-growing annuals be sown. Balsams, Zinneas, Portulacas, Bartonia aurea, Candytuft, Coreopsis, Globe Amaranths, and others will quickly make quite a blaze of colour if the weather continues favourable. Bouvardias may be planted if they are afterwards well looked after. Some of the foliage had better be removed before planting. Roses or rose stocks may be budded wherever the bark will rise or separate easily from the wood.

Dahlias should be flowering satisfactorily, but only in places where they have ample moisture.

Chrysanthemums should make fine growth after the rains; but in places where the rainfall has been but little, the plants are unlikely to thrive unless well watered.

## LONDON DAIRY SHOW.

*Prize Butter.*—The butter that obtained first prize in the unsalted class for colonial butter at the recent London Dairy Show was made at Alstonville factory, Richmond River, from cream obtained from pasteurised milk and ripened with a "starter" from *lactic ferment* prepared in the dairy laboratory of the Department of Agriculture from pure cultures of *bacillus acidi lactici.* As the sending of unsalted butter to London is the severest test of the keeping quality we can can have, this success of pasteurised butter should convince all of an unprejudiced mind that pasteurisation, when properly carried out, is of distinct advantage to butter-making. Butter made on the same lines, by the same factory, won the State export prize last season.

# General Notes.

## CURING AND STACKING COWPEA-VINE HAY.

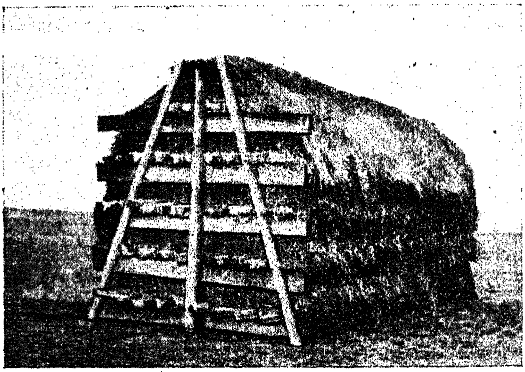
THE practice of putting aside the cowpea crop in the shape of hay for mixing with the winter rations is becoming so favoured that it is thought some wrinkles as to the way to handle this rather cantankerous crop may come in useful at this season. One of the most practical of authorities on hay, pasture, and forage crops is Mr. R. L. Bennett, Director of the Arkansas Agricultural Experiment Station. The conditions of the United States under which Mr. Bennett has gained his experience are, of course, a good deal different to those of New South Wales, but as cowpea culture is only in its infancy here while it is one of the food staples over there, the man with the longer experience can probably tell us most. At any rate, Mr. Bennett says:—"If cowpeas are planted early two crops of hay can be cut in the season. If grazing cowpeas there is only one source of danger to stock, and that is in allowing hungry animals to eat too rapidly and too much of the mature and dry pods. The dry peas, when moistened, will rapidly swell and cause colic. There is no danger from dry peas in hay when hay is fed to stock, as the pods are not numerous enough to do harm.

"The cowpea grows well when planted broadcast, but it does better when planted in rows and is cultivated once or twice with a heel-scrape attached to a cultivator.

"Formerly farmers complained of the difficulty in curing the vines for hay, but now the manner of curing the vines is better understood, and that complaint is seldom heard. There is no difficulty in curing the vines in the field when the weather is dry at the mowing, but frequent rains at that time make curing very difficult." To overcome the difficulty, some time ago Mr. Bennett devised a stack-frame which can be easily rigged up by any farmer, and which will minimise risk of the hay being injured if showery weather should set in at the time of harvest. Following are the details of the stack-frame:—

"The plan of construction is a series of open shelves arranged one above the other. The shelves are wooden rails or poles placed 12 inches apart, with their ends resting on horizontal supports. The supports are nailed 2 feet apart to upright posts, with one end securely in the ground. Strips 1 x 4 with ends resting on the ground are nailed diagonally to the horizontal supports for braces. They are to prevent the frame from inclining, and for supporting and holding in place the ends of the horizontal pieces.

"The length of the stack-frame can be increased indefinitely by erecting frames similar to the one shown in the front end of the illustration and distant from each other the length of a fence rail or whatever is used. These cross frames can be made on the ground and then set in place. The sides of the stack are and must be perpendicular, since pea vines will not turn water. To give the top the proper pitch to turn water the top shelf is made narrower than the shelf below by leaving out the side rails, as shown in the cut. Sufficient straw or grass hay is used for covering, and it must be made to project over the edges of the first wide top shelf so as toturn all the water off the sides of the frame. The dimensions are as follows:—



Width, 10 feet, the planks used were only that long.
Length, three fence rails, each fence rail 11 feet.
Shelves, 2 feet apart.
Rails placed 12 inches apart on the horizontal supports.
Capacity, about 4 tons dry hay.

"The height can be increased until inconvenient to put hay on the top shelf. It would doubtless be cheaper and better to use stout, dry poles of greater length than rails, the frame would be sufficiently strong and a less number of cross frames would be required. Small rails or poles would be better to use than large ones, as they would occupy less space, but the frame material must not be green. It should be observed that free ventilation is allowed in all directions. The cut shows so completely the plan of construction that more detailed instructions for erecting are unnecessary. The cost is very small, two ordinary farms hands can get the material in the woods and erect it. A permanent roof of boards could be used to cover the frame, and in that case, instead of using the diagonal braces, posts could be used, and the ends of the horizontal supports nailed to them. The middle line of posts could be dispensed with or made taller than those on sides to support the comb of the roof, while the eaves would be supported by the lower outside posts.

"*Stacking Hay.*—To put green cowpea vines in the frame all the rails or shelves are taken out, and only the cross frames are left standing. The first floor of rails at the ground are put about 12 inches apart on the horizontal supports. The waggon of hay is then driven alongside and one man unloads the hay on the floor while another evens it until slightly above the place for the next shelf, then the rails or poles for it are placed. The hay is then put on that floor in the same way as on the first, and so on with each floor until the top is reached, when the cover of straw or boards is put on.

"In removing the hay for feeding, it is taken first from the lower floors, and then from those above. The cover being the last removed protects the hay until all of it has been fed out. Beginning on one side of one section the hay can be drawn out of the sides of the two first floors and the rails or poles removed from those floors as they become in the way; the same is done with the remaining ones. To remove all the hay at once work should begin at the top of the stack.

"The vines cure entirely in the shade and retain the flavour, aroma, and a bright green colour, all very desirable qualities. When hay of any kind is cured by being spread to the hot sun these desirable qualities are almost entirely lost.

"The vines can be stacked as soon as wilted; if cut in the morning and exposed to the sun they can be stacked that evening. By stacking the vines when wilted no loss of leaves occurs and the very best hay is made.

"A very important advantage is gained by the use of the frame in that hay can be made independently of the weather. It would be advisable to have such a stack frame on every farm where other hay is made, for in the event of rainy weather at haymaking the hay could be cured and saved, notwithstanding the unfavourable weather.

"Cowpea hay is bulky, and much barn room can be saved by curing and storing in the frames, or by curing in the frame, then baling.

"By having the pea crop ready to cut at different dates and by the use of the stack frame in the event of rain pea hay could be grown extensively and baled for market.

"The frame possesses advantages of requiring a small amount of inexpensive material to build, is easy to erect, is durable, can be easily moved from place to place without tearing apart the cross frames, and hay is easily stacked and as easily removed from the stack.

"To properly cure cowpea hay in sun or open air the mowing must be done after the dew is evaporated from the vines, then as soon as the leaves appear to be drying the vines must be raked in windrows and later in cocks, and finally to cover. The time in which they will cure enough to safely store in bulk will depend on the weather, of course, and the grower must decide that. The best stage to cut cowpeas for the most hay and to make the best hay with least trouble in curing and loss of leaves, is when the oldest pods have turned yellow."

## Fleas.

Fleas deposit their eggs in old carpets, rugs, furs, in undusted corners and crevices in rooms, as well as on cats and dogs. The larvæ are very small, delicate, transparent maggots, which live in the dust in crevices and crannies between the flooring-boards, or under the floors if there are accumulations of dust there. Clearing out periodically all floor-rugs, &c., and either sprinkling them with insecticide, or scalding them and washing the floors with carbolic soap or kerosene soap and water, will destroy all the larvæ. Any dogs or cats allowed inside the house should be frequently attended to. For dogs, strong carbolic soap should be used plentifully enough to give the body a good soaking. Cats are best treated with insecticide, and if the cat is held for a few minutes over a newspaper the sick fleas which drop off can be collected and burnt.

# Market Review.

15 December, 1902.

POULTRY, &c., received at the Government Cold Storage Depôt.

| Date. | Fowls. | Ducks. | Geese. | Turkeys. | Rabbits. | Hares. |
|---|---|---|---|---|---|---|
| 1902. | | | | | pairs. | |
| January ... ... | 6,266 | 1,677 | 197 | 372 | 576 | ......... |
| February ... ... | 12,593 | 3,416 | 326 | 297 | ......... | ......... |
| March ... ... | 17,228 | 2,087 | 324 | 846 | 6,502 | 80 |
| April ... ... | 25,011 | 4,916 | 257 | 186 | 9,751 | 896 |
| May ... ... | 22,605 | 2,382 | 42 | 440 | 36,828 | 1,800 |
| June ... ... | 9,754 | 971 | 26 | 288 | 32,756 | 17,848 |
| July ... ... | 3,484 | 35 | 4 | 74 | 18,060 | 17,064 |
| August ... ... | 1,068 | 5 | 5 | 53 | 7,522 | 20,484 |
| September ... ... | 337 | ......... | ......... | ......... | 310 | 6,084 |
| October ... ... | ......... | 45 | 41 | 65 | ......... | 192 |
| November ... ... | 116 | 709 | 36 | 90 | 672 | ......... |
| Totals... ... | 98,462 | 16,243 | 1,258 | 2,711 | 112,977 | 64,448 |

Besides the above, the following were received :—

| 1902. | | |
|---|---|---|
| January ... | 270 | packages butchers' sundries. |
| February ... | 296 | ,, ,, |
| March ... | 655 | ,, ,, |
| April ... | 225 | ,, ,, |
| May ... | 218 | ,, ,, |
| June ... | 187 | ,, ,, |
| July ... | 64 | ,, ,, |
| August ... | 23 | ,, ,, |
| September.. | 37 | ,, ,, |
| October ... | 21 | ,, ,, |
| November.. | 54 | ,, ,, |
| Total ... | 2,050 | ,, ,, |

| 1902. | | |
|---|---|---|
| September .. ... | 778 | cases eggs. |
| October ... ... | 1,217 | ,, ,, |
| November ... ... | 835 | ,, ,, |
| Total .. ... | 2,830 | ,, ,, |

POULTRY, &c., delivered from the Government Cold Storage Depôt.

| Date. | Fowls. | Ducks. | Geese. | Turkeys. | Rabbits. | Hares. |
|---|---|---|---|---|---|---|
| 1902. | | | | | pairs. | |
| January ... .. | 9,548 | 1,166 | 183 | 170 | 1,566 | 96 |
| February ... ... | 12,921 | 1,075 | 563 | 517 | 348 | 300 |
| March ... ... | 11,833 | 2,018 | 390 | 630 | 3,709 | 136 |
| April ... ... | 10,645 | 2,192 | 332 | 213 | 4,896 | 122 |
| May ... ... | 22,944 | 3,172 | 89 | 479 | 8,679 | 972 |
| June ... .. | 5,383 | 459 | 28 | 226 | 15,699 | 5,248 |
| July ... .. | 7,296 | 3,684 | 54 | 303 | 57,510 | 18,288 |
| August ... .. | 2,407 | 3,152 | 5 | 27 | 14,280 | 21,404 |
| September ... .. | 2,099 | 316 | ......... | 56 | 10,282 | 26,088 |
| October ... ... | 12,442 | 50 | 6 | 16 | 641 | 2,156 |
| November ... .. | 132 | 556 | 49 | 231 | 24 | 892 |
| Totals... ... | 97,653 | 17,840 | 1,699 | 2,868 | 117,634 | 75,702 |

Besides the above, the following were delivered :—

| 1902. | | | |
|---|---|---|---|
| January | 609 | packages | butchers' sundries. |
| February | 262 | „ | „ |
| March | 667 | „ | „ |
| April | 225 | „ | „ |
| May | 234 | „ | „ |
| June | 161 | „ | „ |
| July | 215 | „ | „ |
| August | 37 | „ | „ |
| September | 48 | „ | „ |
| October | 21 | „ | „ |
| November | 40 | „ | „ |
| Totals | 2,519 | „ | „ |
| September | 125 | cases | eggs. |
| November | 4 | „ | „ |
| Total | 129 | „ | „ |

IMPORTS of butter into the United Kingdom for the month ending 30th September, 1901, 1902, and the nine months ending 30th September, 1901, 1902.

*Butter.*

| Countries. | Month ending 30th September. | | 9 months ending 30th September. | |
|---|---|---|---|---|
| | 1901. | 1902. | 1901. | 1902. |
| | cwt. | cwt. | cwt. | cwt. |
| Russia | 34,127 | 47,409 | 310,536 | 419,680 |
| Denmark | 118,718 | 143,389 | 1,234,559 | 1,321,132 |
| Sweden | 13,487 | 21,924 | 144,040 | 144,872 |
| Germany | 388 | 141 | 24,554 | 23,615 |
| Holland | 23,175 | 39,390 | 234,985 | 295,206 |
| France | 27,744 | 39,719 | 230,631 | 294,567 |
| Canada | 33,488 | 35,809 | 132,293 | 176,239 |
| United States | 9,250 | 4,246 | 119,669 | 40,967 |
| Other Countries | 6,149 | 7,648 | 95,853 | 136,599 |
| | 266,526 | 339,675 | 2,527,120 | 2,852,877 |
| AUSTRALASIA— | | | | |
| Victoria | — | 16 | 127,411 | 61,677 |
| New South Wales | — | 6 | 48,589 | 17,615 |
| Queensland | — | — | — | 20 |
| New Zealand | 91 | — | 148,694 | 144,866 |
| | 91 | 22 | 324,694 | 224,178 |
| Total | 266,617 | 339,697 | 2,851,814 | 3,077,055 |

Sydney Market quotations, wholesale, are :—

Wheat—quoted, 5s. 10d. per bushel ; South Australian, 5s. 6d.
Flour—to £12 per ton for City Roller ; Manitoba, £12 5s. per ton.
Bran—1s. 8d. ; pollard, 1s. 9d. per bushel.
Maize—5s. 6d. for River ; Argentine, to 4s. 8d. per bushel.
Barley—Prime Cape feed barley, 4s. 3d. ; malting, to 5s. per bushel.

Chickwheat—to 5s. 10d. per bushel.
Oats—Milling, 3s. 11d.; Tasmanian feed, 3s. 8d. per bushel.
Potatoes—Local Hunter River prime, £8 per ton.
Onions—Local Hunter River prime, £3 10s. per ton.
Oaten Hay—Local prime, £8 10s. per ton.
Lucerne—Hunter River, to £3 15s. per ton.
Chaff—Good local, £6 10s. per ton.
Butter—Pasteurised, 10½d.; prime, 10d. per lb.
Eggs—to 1s. 0½d. per dozen.
Bacon—1s.; Hams, 1s. 2d. per lb.
Poultry—Fowls, to 3s. 9d.; roosters, to 5s. per pair; ducks, to 4s. 6d.; drakes, to 5s. 3d. per pair; geese, to 7s. 6d. and 8s. 6d.; turkeys, to 14s.; prime gobblers, to 18s. 6d.; turkey hens, to 7s. 6d.
Lemons—Choice, 12s. per gin-case.
Oranges—Choice, 16s. per gin-case.
Tomatoes—to 6s per half-case.
Apricots—Prime, 6s. per gin-case.
Peaches—Best China, 3s. per half-case; Briggs' Red May, to 4s. per half-case.
Passion Fruit—Choice, to 16s. per gin-case.
Plums—to 5s. per gin-case.
Nectarines, to 4s. per half-case.
Pine-apples—Large, to 9s.; common, to 5s. per case.
Honey—choice, 3¾d. per lb.

H. V. JACKSON,
Secretary, Board for Exports.

## THE COWPEA FOR DAIRY FARMERS.

THE cowpea is of especial value to the dairy farmer. The roots enrich his soil by utilising the nitrogen contained in the air. The vines, either green or when made into hay, furnish him with that particular class of food so necessary for abundant milk secretion.

Though not so concentrated, they are very similar in composition to wheat-bran. From careful feeding experiments conducted at the Delaware Experimental Station, U.S.A., it was found that cowpea silage was a perfect substitute for bran. The report states that "1 lb. of bran and 6 lb. of cowpea vine silage, when considered chemically, are interchangeable, when considered on the basis of the yield in butter and of milk, the balance was in favour of the cowpea vine."

By growing and feeding cowpea the dairyman is enabled to economically use the rougher and coarser carbonaceous foods, such as maize, sorghum, &c., and at the same time dispense with the purchase of bran and similar costly concentrated foods.

These plants are now in full bloom and may be fed off, taking care to gradually break the animals into their use as a food, to avoid digestive troubles. Start with one hour per day for feeding, and gradually increase the time. Cowpeas also may be cropped for hay or ensilage. Moreover, the cowpea is an excellent fodder for both sheep and pigs.—GEO. L. SUTTON, H. A. College.

VOL. XIV. PART 2. FEBRUARY, 1903.

*Agricultural Gazette of New South Wales.*

# Means to Ameliorate the Conditions of Arid Regions.

IN February last there was published in New York a work entitled "Irrigation in the United States." The author is Mr. F. H. Newell, Hydraulic Engineer and Chief of the Division of Hydrography of the United States Geological Survey Department. Mr. Newell is also Expert on Irrigation for the Official Censuses of the United States, and is Secretary to the American Forestry Association.

Naturally, much that is said by Mr. Newell has little or no direct application to the conditions of New South Wales; but in the chapters on limited annual rainfall, sources of water supply, utilisation of storm-waters, effects of pastoral occupation of country, and conservation of forests, there are many points of the utmost importance to us in the solution of difficulties that beset the occupants of the western lands of New South Wales. This is more particularly so in the case of the basin of the Upper Missouri River—a tract of country where the annual rainfall ranges between 10 and 20 inches; where the contour of the country specially referred to, for hundreds of square miles, comprises rather elevated plains with occasional small belts of forest and great tracts of sparsely-timbered land, sometimes clothed with nutritious grass and herbage and at other times so bare of feed that if the stock were not removed to the mountain slopes they would all perish ere the summer were half spent; where the rivers are nothing but chains of pools in the dry season and raging torrents a few hours after rain; and finally where, under the stress of mixed stocking, to the utmost limit of the capacity of the country in fair seasons, there have been brought about conditions very similar to those which drought, rabbits, and depletion of natural fodders have evolved in parts of New South Wales.

In treating his subject, Mr. Newell gives some interesting data concerning fluctuations of rainfall. As will be noticed in the extracts given below, his conclusions coincide with the views expressed in the *Agricultural Gazette* (August and December, 1902) by Mr. John Barling, that there is a certain regularity in the rainfall as a whole—that is, as Mr. Barling points out, when the period, as far as records go back, is divided off into sets of, say, ten years, the average rainfall for any decade is practically the same.

This information is very encouraging, tending as it does to dispel the fear expressed by some authorities that our seasons are becoming gradually drier.

"The amount of precipitation on the surface of the country, although varying greatly from season to season and from year to year, has been found to have a certain stability when looked at in a large way;—that is to say, although for a series of years the rainfall may have been increasing or diminishing, yet, taking a long record, as, for example, 100 years, it has been found that the average for the first quarter or third of this, is practically the same as that for the last third or quarter. In short, it has not been possible to detect any progressive increase or diminution in the amount of precipitation when records extending over thirty or forty years are had.

"The average of what is termed the normal precipitation for each part of the country can be computed. Departures from this normal may be in one year or another very great, and for a series of years the rainfall may be above or below the normal; nevertheless, the weather conditions seem to swing back, no matter how far they have swayed. The climate may be regarded as fixed, although the weather changes widely and rapidly."

"The fluctuations which have taken place in the volume of different rivers from season to season and from year to year are believed to have a certain range, which can be ascertained by measurements carried on through a number of years in succession. The results at present obtained often appear to indicate that the rivers are steadily diminishing in volume, and the question is frequently asked whether the rivers are not drying up. It has been argued that, in the western part of the country at least, there is a progressive desiccation, and that, as time goes on, less and less water will be available. From geological evidence, it is certain that, in comparatively recent times, as measured by the age of the rocks, the climate of the west was far more humid. On the other hand, records of weather conditions obtained for various parts of the United States, and for European countries, some of them extending over a period of 100 years or more, lead us to believe that the present climate is permanent as regards historical periods; in other words, for the few hundred or thousand years that men have made observations or records, there has been no decided and permanent change in climate, although for the millions of years for which geological data are available, there are found to be decided differences.

"From these and other considerations, it is safe to assume, as in the case of rainfall, that the quantity of water in the rivers of the country is not permanently increasing or diminishing. It is evident, however, that modifications are taking place in their behaviour, especially as regards the amount and duration of floods and of low water. The changes introduced, incident to civilisation—the making of roads and trails which act as conduits or ditches, the draining of swampy places, the cutting of the trees, the burning of forests and underbrush,—all exert a more or less direct influence upon the rapidity with which water runs off the ground after a rain and find its way into the streams; thus, there can be no doubt that springs and smaller creeks at least have been destroyed, or their flow greatly modified."

## Grazing Lands.

"By far the greater portion of the arid West consists of open grazing lands. These vary in their covering of forage plants from the extremely scanty vegetation of the deserts up to the thick turf which is to be found within the mountain parks. The broad sandy deserts occasionally receive a downpour from the local storms or cloud-bursts, and there springs up at once a scanty herbage, which, though apparently dry and woody, is nutritious and is eagerly sought by the cattle. On the less arid plains there are to be found every year a number of grasses and smaller plants or shrubs, which, drying under the intense heat, become in effect naturally cured hay, and which, though sparsely distributed, thus furnish sustenance for horses, cattle, and sheep.

"As summer approaches, and the heat upon the deserts and plains become intolerable, the herds and flocks gradually move up into the mountains, and find excellent grazing upon the broad slopes and open spaces within the forested areas; thus a considerable part of the land which is wooded and forested is also of value for grazing. The interests of the cattle owner, and especially the sheep owner, and of the forester, are sometimes at variance, since the cattle, and more particularly the sheep, when the country has been overgrazed, browse upon the young herbage and prevent the growth of small trees; so it is often important to exclude sheep, and even cattle, from the forests in order that the trees may reproduce themselves. The extension of forest reserves has been frequently opposed by the sheep and cattle interests, and the administration of the reserves has been hampered by the demand for free grazing upon the public lands, but this opposition has now ceased.

"The sheep industry is one of the most important of the arid regions, and the profits are large, so that from a commercial standpoint it is highly important that the grazing lands extend as widely as possible, even into the forest reserves. It is not good public policy to prevent the growth of wool valued at $10 in order to encourage trees which are worth only $1. It is possible, however, to prepare working plans for the forests which, while preventing overgrazing, will permit the use of the forests as a summer range with a minimum amount of injury to the young growth. A general plan has recently been adopted, which it is hoped will ultimately satisfy the irrigators on the one hand, who are concerned in protecting their water supply, and the sheep owners on the other, who demand that their flocks shall graze wherever young plants can be found.

"Forest protection and sheep grazing are not wholly incompatible, for there are certain forested areas where sheep have been and can be allowed to run without serious damage. The exclusion of sheep from the forest reserves should, where necessary, be brought about gradually, so as not to injure this important industry, and the conditions of each locality must be carefully considered before sheep and cattle are either excluded or permitted to graze. The tendency undoubtedly will be to restrict the wide range of the sheep and to bring the industry to the conditions prevailing in older, settled communities, where the sheep are fed through a considerable portion of the year upon improved pastures, or with forage raised by irrigation."

Mr. Newell here demonstrates by means of maps the location and approximate extent of the free, unenclosed grazing lands of the western United States. Some of the land is in private ownership, and, in Texas particularly, much of the pastoral land has been sold or leased to graziers who have fenced off their holdings. The rest of the lands, however, are unenclosed, and their extent can best be realised, perhaps, when we remember that, throughout nearly one-half of the total area of the United States, grazing is the principal industry; and, just as in the western districts of New South Wales, "any plan of reclamation and utilisation of vast and arid areas must take cognizance of this fact and be shaped accordingly."

"Irrigation may be regarded from one standpoint as an outgrowth or later development of the grazing industry, especially in the more northern part of the arid region. In the early days the sheep and cattle on the open ranges at the approach of cold weather were brought into the lower valleys or sought natural shelter. During severe winters the losses were very large, occasionally one-half of the stock dying during long-continued or extremely stormy weather. With the increase in the business and the overstocking of the ranges, the necessity of providing winter feed for the young or less vigorous animals became more evident, and at the home ranches small areas began to be irrigated in order to provide forage for the winter.

"This process has continued to a greater and greater extent, until a balance has been reached between the available summer range and the winter food supply raised by irrigation; that is to say, a cattle owner can maintain as many animals as he can feed for two or three months with forage raised by irrigation, provided he can obtain sufficient range. If, however, his summer range is limited, or is partly injured by the incursions of sheep, he may find it economical to increase the amount of feed raised by artificial watering.

"The tendency in the stock-raising business is toward an increase of small owners and decrease of great herds and flocks, owing to the competition for summer range and the necessity for providing an increased amount of winter feed. There is a gradual evolution from stock raising toward what is sometimes known as stock farming; that is, the owner of a relatively small herd is tempted to put his irrigated land into other crops besides forage, or to raise an additional amount for sale in local markets. Thus, in the stock-raising districts there is a gradual development toward intensive farming.

"Nearly every settler upon the public domain, even though intending ultimately to raise the ordinary farm crops and fruits, requires for a time a certain amount of grazing land. He must have a few draught animals and dairy cows, and, as a rule, finds it profitable to own a small herd of cattle or a band of sheep. He desires and needs the use of the public land in his vicinity, in order that he may herd his cattle near his home and bring them in each day or at frequent intervals.

"Under existing law the settler who is making a home has no legal claim or right to the use of this public land other than the right possessed by every citizen of the country. Thus, there frequently occur acts which seem to the settler to be grossly unjust, in that cattle or sheep belonging to some non-resident individual, or to a wealthy corporation, may come upon the land in his vicinity and destroy all of the nutritious vegetation, leaving his own cattle to starve. Since the settler is trying to make a home, and is paying taxes for the maintenance of law and order, he feels that he has a superior right to the use of the unoccupied land, at least until the land is wanted for homes by other settlers, or until he is in position to raise by irrigation sufficient forage for his cattle. Thus the settler is often at war with the cattle and sheep owners, and many areas which might have been utilized for homes have been kept vacant through fear of depredations by the cattlemen or even as the result of open violence.

"On the free range there are also controversies between rival live-stock owners, and particularly between the sheep owners and the cattlemen. The two kinds of animals cannot graze on the same area, and, as a rule, a band of sheep will render the range unfit for cattle and will drive the latter out. With the growth of the wool industry, the range devoted to cattle is being encroached upon, and many of the owners are disposing of their herds and going into the sheep business, finding it possible to make a living on the public lands by sheep grazing when not successful with cattle.

"In many localities there has come about what may be termed an armed neutrality among the various interests concerned with use of the public land. The settler and irrigator, having obtained a foothold, has been able, by combining with his fellows, and by show of force at times, to secure for himself the use of certain pieces of public land for grazing. The cattle companies and larger owners have, as a rule, found it good policy not to encroach upon the settlers who are already established, and have combined with these men to exclude sheep from the cattle range used by all in common. The sheep owners, after various conflicts and conferences, have agreed to abide within certain other ranges, and for a time at least peace has been assured and all have been fairly content.

"The condition just noted is an unstable one, likely to be upset at any moment by the gradually increasing herds of one or another of the parties to the mutual understanding, or by erratic bands of sheep. For example, by tacit consent a certain mountainous or hilly area may have been set aside for cattle grazing for the benefit of the inhabitants of a portion of a county. It has frequently happened that the owner of large bands of sheep in another State, learning that the grazing is good in this area, sends great bands, aggregating 50,000 or 100,000 sheep, through this part of the country, travelling toward the mountains or market. Such hordes of sheep, progressing slowly, literally destroy all edible vegetation, devastate and ruin the land, and completely upset all local customs and privileges. Occasionally an inundation of this kind is resisted by force, and from time to time local newspapers have a brief item to the effect that an unknown sheep breeder was found dead in a remote spot, or that bands of sheep have been dispersed or driven over cliffs by unknown persons.

"With the uncertain conditions surrounding the use of the public lands, it is a natural consequence that practically all the farmers and irrigators of the arid region, as well as the stockmen, ask that there be accorded the grazing lands some definite treatment by which, pending complete or final settlement, temporary rights may be had to the use of the forage. It is highly essential for all concerned to be able to enjoy undisturbed possession from year to year of certain lands to be used for grazing purposes. For such a license the owners of the sheep, cattle, or horses are willing to pay a suitable compensation.

"The necessity of restricting grazing on portions of the public domain has become apparent, particularly in Arizona, where in the southern part of the territory there are areas upon which the industry has practically exterminated itself. In one locality in the vicinity of Tucson, where formerly 20,000 head of cattle ranged, only a few hundreds can now find subsistence. This is due to the fact that some years ago, when there was a decline in the value of cattle, the shipments were reduced and the herds multiplied. Then came a season when the drought was severe, the feed became scanty, and the starving cattle ate practically every living shrub, digging down even to the roots, so that plants and cattle perished together. The few cattle remaining have been sufficient to prevent the forage plants from spreading again, but where small areas have been enclosed the native grasses have come back and are flourishing.

"This natural recovery of the enclosed range has been demonstrated by the Agricultural Experiment Station of Arizona. A field of 350 acres has been fenced and carefully studied, the conditions of rainfall, moisture distribution, and plant reproduction being observed. It has been shown that the grasses, when protected, not only spread over the ground, but also serve to obstruct the rapid run-off of the water resulting from the sudden and capricious storms of the country. The vegetation causes a greater portion of this water to sink into the soil, where it is stored for future use by the plants.

"The Papago Indians of the south-west, living by crude methods of agriculture, have learned how to make use of the erratic water supply, and have demonstrated the practicability of storing flood waters in the soil. Whenever it rains and the water runs down the little gullies near their lands, every man, woman, and child turns out in the storm and builds small dams, or levees, holding the water as far as possible on the series of hastily-constructed low terraces. When the water sinks in they at once plant corn upon the wet surface, and as a result the tribe is fat and happy during the next winter. Observation has shown that even as small an amount of rain as 0·1 inch will cause running water on lands denuded by excessive grazing. If, however, this water can be held back by the plants, it will soak into the ground and soon increase the supply of forage.

"There is a balance which must be preserved between the interests of the cattlemen in keeping the largest possible number of cattle on a range and those of irrigators and the public in general in securing the best ultimate use of the lands. Too many cattle means the destruction of the forage plants, washing of the soil, rapid run-off, and accumulation of silt in the lower rivers. In a larger way it is really to the interest of the cattlemen not to overstock the range, but for immediate individual gain this is always likely to happen unless regulated.

"By totally excluding cattle from certain depleted areas it may be possible to restore these after a few years, and the natural growth can be further increased by the construction of inexpensive embankments thrown up by suitable machines or graders, such as to bring out upon the grazing land the waters which from time to time come rushing down the little gullies. It has been shown on a small scale by the experiments at Tucson that these embankments can be made by hand at a cost of less than $1·00 per acre, sufficient to distribute the storm waters and allow these to soak in, resulting in a yield of grass in that dry climate dense enough to be mowed by a machine. Instead of three-quarters of the water rushing off to waste, practically all of it can thus be held on the upper catchment basins of the rivers and the value of the range land enormously increased.

"Under present conditions there is no inducement for any person to guard or protect the open range land, and as a result the valuable forage plants are eaten down so closely as to be destroyed. If, however, one man or an association of men, had the exclusive right to the grazing on a certain area for a term of years, it would be to his or their advantage not to overstock the range, but to treat it in such a manner that it would not deteriorate.

"Should any law be enacted regulating the temporary use of the public land for grazing, it should be framed in such a way as not to retard the development of irrigation and the settlement of the land by homesteaders. It is probable that the licenses granted for grazing could be made subject to the deduction of relatively small areas for settlement without in any way interfering with the value of these licenses. The great object is to promote the permanent settlement of the country and the making of homes.

"In order to provide wise laws, it is necessary to take cognizance of the customs which have resulted from experience. In nearly all counties of the arid States certain practices have arisen in regard to grazing, many of which might be recognised as binding, temporarily at least, until better systems are devised. For example, it has been customary to take sheep from the winter feeding grounds, where forage raised by irrigation has been provided, and drive them out along certain portions of the cattle range up into the mountain valleys to spend the summer, later bringing them back again by a different route. This right of transit must be recognised in any license given for cattle grazing, and yet must be so guarded as not to be capable of abuse by keeping the sheep too long on the road and allowing them to eat too great a proportion of the vegetation.

"Provisions in permits for sheep grazing can be made comparatively simple, since the sheep are always herded and are under complete control. With cattle and horses, however, close herding is impracticable, except in the case of small numbers owned by settlers. It is generally impossible to assign a definite range to a certain owner, as the cattle cannot be kept within bounds without expensive fences, and the fencing of the public domain is and should continue to be illegal. The use of individual cattle ranges is to a large extent impracticable, except by owners of great herds. As a rule, it will be necessary to allow the cattle range to be used in common by many owners, the number of head of stock being agreed upon.

"This matter of the regulation of grazing has been emphasised in the preceding pages, as it is one of fundamental concern in any new country, and has an intimate relation to the development of irrigation and the complete utilisation of the public domain. The land laws, which, as before noted, have been made with reference to the humid conditions, have not recognised this fact, and thus the rights of the pioneers have been left undefined and to the arbitration of force rather than of law."

## Requirements for Water Storage.

The requirements for successful water storage on any considerable scale are: an abundance of water to be stored, capacity in which to hold this, favourable situation for a dam, and suitable material for its construction, and also reasonable cost of labour, material, and land, if any is purchased, for right of way or flooding.

The amount of water to be stored should in all cases be ascertained in advance by careful measurements made through a number of seasons at the point where the water is to be held. Disappointment and financial loss have resulted from assuming that there will undoubtedly be plenty of water, or by taking the statements of the "oldest inhabitants" to this effect. It is impossible to judge by the eye as to the volume of a flood. One which is particularly destructive and impressive in its apparent magnitude may, upon careful measurement, be found to have discharged an amount far less than anticipated. The intensity of the flood, or rapidity with which it moves, often gives an exaggerated idea of its volume.

Many serious blunders have been made because of lack of definite information concerning the water supply. Persons dwelling along the bank of a stream often entertain absurd notions concerning the quantity flowing at ordinary or high stages. They have no means of forming a correct conception of volume, and will confidently assert that there is enough water to irrigate a million acres, when, as a matter of fact, there may be sufficient for only ten thousand. The investor, and even the engineer visiting the locality, may become infected with this optimistic spirit, and consider useless any further delay or expenditure to ascertain the fluctuations of the stream. Being impatient to begin work, they will take the statements of the people, and base their plans upon these.

"In a well-known instance of the construction of a large storage dam which was under consideration for ten years or more, no measurements of volume of water were made, but when the constructing engineers were employed they were assured that the stream at that time was at a low stage. It was then carrying 2,000 second-feet. As a matter of fact, it was really in moderate flood, and the low-water flow, six months earlier or later, was less than one-tenth of this quantity. The structure was planned and built without further delay, as the engineers did not consider that they had any duties beyond putting up the desired structure; but when finished, disappointment and loss of investment resulted, it being then found that there was not enough water.

"The actual capacity of a proposed reservoir site is also often found to be disappointing upon careful survey. In going into the mountains where the slopes are steep, the eye is misled as to slight inclinations of surface. Valleys which seem to be flat are often found, when a levelling instrument is used, to be decidedly inclined, and instead of a dam 100 feet high backing up the water 3 miles, as at first estimated, it is not unusual to discover that the water will be ponded for a distance of 1 mile. In short, many localities which upon the first search are thought to be desirable are later found to have less capacity than anticipated. It is essential, therefore, to follow the preliminary examination by mapping each proposed reservoir site."

## Methods of Irrigation.

"While methods of conserving and conducting water have been improved under the stimulus of modern invention, the application of water to the soil has been left to experience gained largely by accident and through failure. There is great need of long-continued systematic study and acquisition of knowledge concerning the actual effect which the water has upon the soil and upon the plants. We can see the ultimate result, but have only a vague conception of the steps by which this result is produced.

"Most of the farmers practising irrigation in the United States use quantities of water far in excess of those theoretically demanded or actually beneficial to the crops. This is in line with the general prodigality of pioneer life, and with the habits of shiftlessness so easily acquired where an abundant supply of water can be had. It is so much easier to open the ditches and let the water flow freely than it is to guard and guide each tiny rill, that for economy of time and labour, if not from actual indolence, the irrigator is apt to let the water go its own way.

"It is sometimes stated that irrigation is a lazy man's way of cultivation. The reverse is the case wherever the best results are obtained. Irrigation, properly conducted, means intensive farming and application of water with great care, followed by thorough cultivation of the moistened soil.

"Different plants require different amounts of water. Some are satisfied with a very little. Others require a great deal, and cannot do without it. Still others are relatively indifferent as to whether much or little water is applied; they have the habit of adjusting themselves to circumstances. Each crop therefore has different needs, and the practice of irrigation must vary accordingly.

"It is not merely the character of the plant which has to be considered, but also the quality of the soil. Certain soils receive and transmit water with great rapidity,—such, for example, as sand and gravel. Others, like clay, take water slowly and hold it with great tenacity. Thus the manner and time of irrigating certain plants will vary according to the ability of the soil to hold and supply water as needed. If the moisture escapes rapidly, as from sand, the plant after a few days is not able to receive enough and begins to droop. On the other hand, if the soil is very compact and the water is held from escaping, the soil may become water-logged, air cannot penetrate the interstices, and the plant suffers from drowning.

"There is still another factor in the production of crops which must be considered besides sunshine, soil, and water. This is the low order of vegetable life known as nitrifying organisms. These, in the presence of air and moisture, manufacture food for the plant and are its servants in preparing material upon which it thrives. A certain amount of water is needed for these nitrifying organisms, but, on the other hand, too much water stagnates and destroys them. Thus it is that there is a very delicate adjustment to be preserved in respect to the amount of moisture in order to procure the best results. These conditions the successful irrigator learns by experiment and failure, and unconsciously follows certain rules which he is usually unable to put into words.

"There has been very little progress in the practice of irrigation from the methods of ancient times. This is due largely to the fact that the men who are now bringing new lands under ditch have for the most part received their training as farmers in humid regions, and find it difficult to unlearn many of the facts which they regard as fundamental, and to reverse the habits of half a lifetime. They hesitate to adopt the methods of the Indians and Mexicans, despising these as crude or childish. Nevertheless, these primitive peoples have, through the experience of generations, acquired certain ways which are worthy of study, particularly in the direction of using the smallest possible amount of water in oases on the desert. When they have plenty of water, the Mexicans use it wastefully; but where the amount is extremely limited, some of them, particularly the agricultural Indians of the south-west, have acquired the art of utilising every drop. Even the drippings from the family water jar are arranged to fall upon a growing plant, and the moist spots are carefully guarded for the growing of corn or beans."

## Amount of Water Required for Crops.

"The amount of water required for raising crops varies according to soil and other conditions. The plant itself needs a certain minimum supply in order to receive and assimilate its food and to keep up transpiration. A far larger quantity is required to saturate the surrounding soil to such a degree that the vitalising processes can continue. The soil is constantly losing water by evaporation and by seepage, so that the amount which the plant takes from it is relatively small. Nevertheless, the moisture must be maintained within narrow limits in order to produce the most favourable conditions of plant growth.

"Experiments have been made to determine exactly how much water is needed in order to keep the soil in proper condition for plants of different character. Among the most important investigations are those by Professor F. H. King of Madison, Wisconsin, who has found by direct measurement that from 300 to 500 pounds of water are required for each pound of dry matter produced; in other words, for each ton of hay raised upon an acre, 300 to 500 tons of water must be furnished either by rainfall or by artificial means.

"Water covering an acre 1 inch in depth weighs about 113 tons, and to produce 1 ton of hay the depth of water required is approximately from 3 to 5 inches. It is necessary to furnish at least this amount, and sometimes several times as much, in order to produce a crop. The actual amount used in producing 5 tons of barley hay to the acre has been about 20 inches in depth. Much depends upon the permeability of the soil, and its ability to hold water.

"The quantity of water used in irrigation is usually stated in one of two ways—either (1) in terms of depth of water on the surface, or (2) in quantities of flowing water through the irrigating season. The first method is preferable, since it is susceptible of more definite consideration, and is also more convenient for comparison with figures for rainfall, which are given in inches of depth. In the humid regions rainfall is usually from 3 to 4 inches per month during the crop season. In the arid region, where the sunlight is more continuous and the evaporation greater, there should be, for the ordinary crops at least, enough water during the growing season to cover the ground from 4 to 6 inches in depth each month. Carefully tilled orchards have been maintained on far less. In Arizona, where the crop season is longest, being practically continuous throughout the year, twice as much water is needed as in Montana, where the crop season is short and the evaporation is less.

"The second method of stating the quantities necessary for irrigation is of convenience when considering a stream upon which there is no storage. It is frequently estimated that one cubic foot per second, or second-foot, flowing through an irrigating season of ninety days, will irrigate 100 acres. One second-foot will cover an acre nearly 2 feet deep during twenty-four hours, and in ninety days it will cover 180 acres 1 foot in depth, or 100 acres to a depth of 1·8 foot, or 21·6 inches. This is equivalent to a depth of water of a little over 7 inches per month. In several of the States, laws or regulations have been made to the effect that in apportioning water not less than 66⅔ acres shall be allowed to the second-foot of continuous flow. This is extremely liberal, and permits extravagant use of water.

"When the ground is first irrigated, enormous quantities of water must sometimes be used in order to saturate the subsoil. It has frequently happened that, during the first year or two, a quantity of water which would cover the ground to a depth of 10 to 20 feet has been turned upon the surface. Frequently for several years an amount equal to a depth of 5 feet or more per annum is thus employed. Gradually, however, the dry soil is filled, and, as stated in another place, the water table is raised nearer the surface, less and less water being needed.

"The farmers, being accustomed to the use of large quantities of water, often find it exceedingly difficult to get along with less, and continue to use excessive amounts, often to their own disadvantage. They are actuated in part by the consideration that, having paid for the use of the water, they are entitled to a certain quantity, and fear that if they do not take all of this their claim to it may be disputed. Some of them actually waste water to their own detriment from the mistaken belief that in so doing they are establishing a perpetual right to certain quantities.

"With the gradual development of the country, and the bringing of more and more land under ditches, the need for water increases, and equity demands that no irrigator shall take more than he can put to beneficial use. Flowing water must be considered as a common fund, subject to beneficial use by individuals according to orderly rules, each man taking only the amount he can employ to advantage. Under any other theory full development of arid regions is impossible.

"It is instructive in this connection to know what is the least amount of water which has been used with success. To learn this, it is necessary to go to South California, where the supply of water is least, relative to the demand made upon it, and the economy is correspondingly greatest. Successive years of deficient rainfall in California from 1897 to 1900, while working many hardships, served to prove that with careful cultivation, crops, orchards, and vineyards could be maintained on a very small amount of water. In some cases an amount not exceeding 6 inches in depth of irrigation water was applied during the year, this being conducted directly to the plants, and the ground kept carefully tilled and free from weeds.

"During these times of drought some fruits, as, for example, grapes, apples, olives, peaches, and apricots, were raised without irrigation, but a most thorough cultivation was practised. Some fruitgrowers insist that, in the case of grapes, for example, the quality is better when raised without artificially applying water, although the quantity is less. It has been stated that in raisin-making there is less contrast than might be expected between the irrigated and non-irrigated vineyards, for although the yield of grapes raised by watering is far heavier, yet after drying the difference is not so marked. Wheat and barley, also, according to some farmers, make a better hay when cultivated dry, but the weight is less. Shade trees, such, for example, as the eucalyptus or Australian blue-gum, the catalpa, mulberry, and acacia, grow without water artificially applied, but do not reach the extraordinary development that they do when near irrigating ditches. It is almost useless to attempt to raise the citrus fruits without plenty of water.

"The quantity of water necessary to irrigate an acre, as estimated by various water companies in Southern California, ranges from 1 miner's inch to 5 acres to 1 miner's inch to 10 acres, the miner's inch in this connection being defined as a quantity equalling 12,960 gallons in twenty-four hours, or almost exactly 0·02 second-foot, this being the amount which has been delivered under a 4-inch head measured from the centre of the opening. Under this assumption 1 second-foot should irrigate from 250 to 500 acres. This is on the basis of delivering the water in pipes or cemented channels in the immediate vicinity of the trees or vines to be irrigated.

"If it is assumed that 1 miner's inch is allowed for 10 acres, or 1 second-foot for 500 acres, this quantity of water flowing from May to October, inclusive, will cover the ground to a depth of a little over seven-tenths of a foot, or 8·8 inches, a quantity which, with the care and cultivation usually employed, has been found to be sufficient for some orchards. Mr. W. Irving, Chief Engineer of the Gage Canal, Riverside, California, states that for the year ending September 30, 1899, water ranging in depth from 1·78 to 2·48 feet was used in addition to the rainfall of 0·47 foot. This was less than the usual quantity, economy being enforced by shortage of supply.

"The method of applying water governs to a large extent the amount used. In the case of lucerne, flooding is usually practised; with small grains in most parts of the West the water is run in furrows; while in the case of orchards the water is sometimes applied directly to each tree. In this case a little earth basin, about 6 feet or more across and 6 inches deep, is formed around each tree and partially filled with water. The better way, however, is that of running water in furrows, four or five of these being ploughed between each two rows of trees. The water is applied very slowly, several days being spent in watering 5 acres, and when dry the ground is thoroughly cultivated.

"The annual charges for water by the acre in Southern California, where this economy of water is practised, have been as low as $3, and from this rising to $6 or more per acre. In the case of the San Diego Flume Company, it is stated that water was sold for $600 per miner's inch, with an annual charge or rental of $60, 1 miner's inch being considered sufficient for from 10 to 20 acres. The annual charge for water, taking the arid region as a whole, has averaged by States from 50 cents to $2·00 per acre, or $1·25 (5s. 2½d.) per acre for the entire country.

"The conditions in Southern California, while they may be considered as exceptional, yet indicate the limiting or ideal conditions of economical use of water. For good farming in other parts of the arid region, 12 inches of water in depth during the crop season should be sufficient, except in the case of lucerne and other forms of forage which are cut a number of times, when at least from 4 inches to 6 inches should usually be given to a cutting. As previously stated, the character of the soil, the temperature, and the wind movement introduce so many conditions that broad statements of this kind are merely suggestive, and not to be followed as rules.

"Irrigation is usually carried on during the daytime, and it is unusual for water to be applied during the night other than to arrange the head gates and allow the water to flow to certain portions of the field. In times of scarcity, however, when water can be had only at certain hours, night irrigation must be carried on, and the water carefully applied, with as much skill as possible in the darkness. Night irrigation, although possessing disadvantages, has many advocates. The air being cooler, excessive evaporation is checked, there is less loss and consequently more economy in use, and the plants are not so suddenly chilled as during the heat of the day when cold water is run upon the fields; and the proportional amount of water received during the night is often greater than during the daytime, and the charge of cost is correspondingly less; so that, for economy in various directions, night irrigation is sometimes preferred."

## ARTESIAN WATER.

MR. D. POLLOCK, of Goodooga, has furnished the following report of his experience of artesian water from the Goodooga Bore:—

"I came here some five years ago and settled down on a piece of ground which the people about this part call scalded ground, as it will grow nothing. However, I believed that if water could be applied crops would grow well enough, so I commenced to experiment. I bought from a Sydney seedsman a few different kinds of grass seeds, trees, and shrubs, and planted them in this apparently sterile soil. The grasses all grew for a time, but owing to the drought died off. I tried again, and now the same varieties are all doing well. The Moreton Bay fig and silky oak are making rapid growth. I have also grown to perfection, wheat, oats, rye, Cape barley, and lucerne, and have at the present time (middle of December, 1902) maize which has every appearance of turning out a success. From this I am convinced that the Goodooga artesian water, which I have used to irrigate my plantation, will produce anything; but the water must be carefully applied, and the soil properly cultivated. I came from the Camden District, and am of the opinion that where good farming is not practised the results from artesian water can scarcely be expected to be a success. In this district there are three Chinese gardeners, all of whom buy the artesian water for their gardens. One in particular, located in the Biree River, about a mile and a half from the bore, has about 800 fruit trees, which have been kept alive by the artesian water.

"It is no use saying the Goodooga artesian water will not grow anything. I am pleased to state that several people here have followed my plan, and now there are to be seen growing quite a number of patches of greenstuff, which comes in very handy in this drought-stricken part. There are also a few young trees planted about the street, which at one time was devoid of anything green, with the exception of my own trees, which I have had for about three years."

# Drought Fodder.

A. G. HUMBY,
Bolero, Narrandera.

In a time like the present, when, especially in the Riverina, crops have in most instances failed, and there is not a vestige of feed round the homestead, while the price of ordinary chaff is so high that farmers and others who have a few remaining stock of cattle, horses, &c., are at their wits' ends to find feed for them, the experience and suggestions of one who has tried various fodder plants in the Riverina district for the past ten years may be of some little service.

I would first say that I fear much of the very valuable information and instruction given *re* these matters per medium of the *Agricultural Gazette* is not appreciated as it should be, and I have often heard folks say: "It is all very well to try these things at the experimental farms at the expense of the Government, but we have not the means nor the various up-to-date implements or conveniences at our disposal, therefore it is useless for us to try." My experiences of sorghum-growing in dry seasons in the Riverina, and entirely without the aid of these up-to-date machines and methods, may encourage some who have not given it a trial to do so now.

I find that very few people in these districts appear to know much about the benefit to be gained by growing sorghum according to requirements, either in small or large quantity.

Every one owning from one cow upwards should put in a patch of this valuable fodder plant, more especially in dry seasons. Though in ordinary seasons sorghum should be planted in September and early in October in these districts, under present conditions it is not too late to sow now if done immediately. I have planted in September and October, and not had sufficient rains until the middle of the following February to bring it up, and then had a splendid crop. I quote this to show that there is still time to put some in for a trial this season.

The particulars of this trial are as follows:—Sown in September and October, 1897; first fall of rain worth recording, 1st January, 1898, 53 points, not sufficient to germinate the seed; on 11th February, 33 points, followed by 356 points on the 13th, and 7 points 14th; no rain during March, and 30 points in April—total, 479 points. I had in about 16 acres. As soon as it was about a foot high I commenced feeding from it by thinning it out and feeding to cows. From this to cutting for ensilage I fed about fifty head cattle and horses daily, and then cut quite 50 tons for ensilage at the end of April, which provided for the cattle and horses for the winter, the cows being particularly fond of it, and milking well on it.

The two varieties I have sown, after various trials, are the Sorghum Saccharatum, or black-seeded, and the Planter's Friend. My experience is that the Saccharatum is the better of the two with scarcity of rain, though, through the Planter's Friend being the hardier of the two, it will last on longer into the colder spring weather best. The Saccharatum also, through containing a larger amount of saccharine—consequently being much the sweeter—is greatly relished by all stock—cows, horses, sheep, and pigs, which eat it greedily and thrive well on it. We also cut it up when very green by putting it through the chaff-cutter on the short cut, and it then makes splendid feed for poultry.

I would always recommend planting an equal quantity of each of the above varieties; while for abundance of wonderfully succulent fodder every one growing sorghum should also try a patch of Brown Dhoura. This variety for rapid and abundant growth in my experience excels.

All the varieties mentioned bear feeding-off or cutting down for feeding to stock, and will then stool out and produce a much more prolific second growth. I have had Brown Dhoura in its second growth with half a dozen stalks from each root, each stem about 1½ to 2 inches thick and 2 feet to 9 feet long, with large broad leaves 2 to 3 feet long and 3 inches broad. Cattle, sheep, horses, and pigs greedily eat every portion of it. If allowed to seed and ripen under fair conditions, it yields a heavy crop of seed, equally as good as wheat or barley for horses or poultry. I have heard of it yielding up to 200 bushels per acre.

My method of cultivation has been most simple. I give the land a good ploughing to about 6 inches in depth. If intending to sow broadcast, have the land well harrowed first with your heaviest harrows to fine it down as much as possible, then sow and harrow again once or twice according to condition of the land.

If sowing in rows, as I have no improved seed-sower for sowing the small quantity required, I simply walk up the furrows dropping the seed sparingly by hand in the furrows about 3 feet apart, after which harrow once or twice (*with the furrows; not across them*).

For sowing in rows I find 4 to 5 lb. per acre ample, and for broadcast 6 to 8 lb. per acre, or perhaps up to 10 lb. If thought desirable a few more pounds, say to 12 lb., per acre may be sown; the stalks will then be smaller.

My experience is that the above varieties grow with the least quantity of moisture of any fodder plant I have tried. As long as they get rain enough to give a fair start, and if followed with good rains, the yield will go up to 10 tons and over per acre. My plan for making and storing the ensilage was simple but effective. I excavated down about 5 feet, and erected a building like a large room 10 feet high, 20 feet by 12 feet, using ordinary studs as if for weatherboards, and lined the inside with 6-inch by 1-inch T. and G. flooring boards, also flooring the bottom. The building being half below ground served to keep all air out at the bottom. I had the chaff-cutter elevated on to one end, and then cut by means of horse-power, the ensilage falling into the pit and only needing levelling off as the pit filled. I then covered the top with anything available to keep out air, and finally laid on top another floor of 6-inch by 1-inch boards in sections of four boards each battened together, and on this placed bags of earth (anything will do for weight), finally filling up with some loads of melons, &c., in store for pigs.

I have given my account of the silo and ensilage to illustrate how simple the whole business is. The only improvement I mean to make for future use is to make my one compartment silo into three or four compartments, so that air shall not get at the whole bulk at once when using.

Much has been said at various times about cattle being poisoned by eating sorghum. This I can repudiate, for in my ten years' experience of its use I never had a single head of stock affected in any way by it, and I can say I have used it in all stages of its growth from a foot high to maturity. All that is necessary is to observe caution, especially when first beginning to feed on it. Injurious effects on cattle are caused by greedily eating any green feed such as lucerne, wheat, barley, sorghum, &c., when the animals are not used to such food, or when first they come off dry feed. I had a bullock die once through getting an overfeed of nettles.

I consider after fair test (that of ten years) with cows, working bullocks, and horses, that if judiciously used at first there is no more danger in feeding on sorghum than lucerne, barley, &c., for once the cattle are used to the moist green feed you cannot give them too much.

Farmers who decide to give sorghum a trial this season will, if they plant at once and are favoured with fair rains, have cause to be thankful, for according to quantity sown they should by this means be able to provide feed for ploughing, especially if chaffed up and mixed with a portion of ordinary chaff, though horses will feed and work well on it alone. The nearer it approaches maturity the better, and when the seed is ripe it furnishes grain enough to become substantial feed. My advice is give it a trial from a small patch to 10 or 20 acres for the farm use.

I have just sown a splendid sample of seed (and which is now coming up well). I am advised that no more Sorghum Saccharatum seed could be obtained in Sydney, but Planter's Friend and Early Amber cane are both procurable, and probably Brown Dhoura.

## A GOOD CABBAGE.

IN August, 1901, Mr. T. F. Ellis, of the Howlong Viticultural Station, received for trial a small package of the seed of a cabbage named "Phenomenal."

Having grown two batches of plants from the seed, Mr. Ellis now furnishes the following report:—As a cabbage, I consider this variety all that could be desired. The quality is excellent, and for culinary purposes the cabbage is the best I have seen in this State. It is nearly all heart, average weight 8 to 10 lb., a few 12 to 15 lb., and is neither strong in flavour nor stringy, even after remaining in heart for three or four months.

The second batch was equal to the first.

# Pot Experiments to Determine the Limits of Endurance of Different Farm-Crops for Certain Injurious Substances.*

By F. B. GUTHRIE and R. HELMS.

## Part I.—Wheat.

The following experiments were carried out in order to test the effect upon the growth of the wheat-plant of a few of the chemical substances occasionally present in the soil and in manures, and which are known, when present in excessive quantities, to seriously interfere with the growth and development of the plant.

The experiments were carried out in cylindrical culture pots of galvanised iron, 8 inches high and 8 inches in diameter. The pots were watered from below by means of an external tube, communicating with a channel in the bottom of the pot, a quantity of cinders and broken earthenware being first introduced to ensure thorough aeration and drainage. The pots were filled with the soil chosen for the experiment, each pot containing about 18 lb. of the soil. Through the kindness of Mr. Maiden, a space was set apart in the Botanic Gardens in the open air, so arranged that a tarpaulin could be at once unrolled to cover the whole experiment in the event of heavy rain or wind. All the pots were exposed to exactly the same conditions as to light, warmth, water, &c., throughout the course of the experiment. Check-pots were also filled, sown, and treated in exactly the same way for purposes of comparison, omitting the substance whose action was being studied.

### Nature of the Soil.

Two kinds of soil were used. That with which the pots were originally filled, and in which grain was sown on June 3rd, was a mixture of about one part of a light sand, one part of clay, and two parts of loam. Each pot received in addition the following fertilising mixture:—15 grms. sulphate of ammonia; 6 grms. super-phosphate; 4 grms. sulphate of potash; together with varying quantities of the substances whose action was under investigation.

The composition of this soil was as follows:—

| | | |
|---|---|---|
| Moisture ... ... ... ... | 3·83 | |
| Organic matter ... ... ... | 13·75 | |
| Nitrogen ... ... ... ... | ·208 | |
| Soluble in strong HCl. | | |
| Lime ... ... ... ... | ·165 | per cent. |
| Potash ... ... ... ... | ·065 | ,, |
| Phosphoric acid ... ... ... | ·107 | ,, |
| Magnesia ... ... ... ... | ·072 | ,, |

---

* Read before the Royal Society of New South Wales, October 8, 1902.

The soil was found to contain in addition ·016 per cent. sodium chloride, so that the percentages of common salt in the pots must be increased by this amount. On this account the pots that were resown on subsequent dates were filled with soil No. 2, which was one in which potatoes had been growing.

The composition of soil No. 2 was as follows :—

| | |
|---|---|
| Moisture ... ... ... ... | 2·91 |
| Organic matter ... ... ... | 8·33 |
| Nitrogen ... ... ... ... | ·070 |
| Soluble in strong HCl. | |
| Lime... ... ... ... ... | ·440 |
| Potash ... ... ... ... | ·077 |
| Phosphoric acid ... ... ... | ·110 |

This soil was free from chlorides and did not receive any manure.

## Experiments with Common Salt.

Five pots were filled with soil No. 1, together with the complete fertiliser and the following quantities of sodium chloride, per 100 lb. of soil :—

No. of pot 15, ·01 per cent. NaCl. (Common salt).
„ 16, ·05 „ „
„ 17, ·10 „ „
„ 18, ·50 „ „
„ 19, 1·00 „ „

As it was found afterwards on analysis of this soil that it contained ·016 per cent. NaCl, the above figures become ·026, ·066, ·116, ·516, and 1·016 respectively.

The pots were sown on June 3rd with 10 grains of wheat in each pot. A light mulch of shredded cocoa-nut fibre was placed in each pot and the earth kept slightly moist throughout the experiment.

On July 1st notes were taken as to the appearance of the different pots.

15, had germinated well; growing vigorously. (The grain is now in the ear, October 8th.)
16, had germinated well; growing well but not as vigorously as No. 15.
17, had germinated well; growing less vigorously than No. 15.
18, had not germinated.
19, had not germinated.

Pots Nos. 16, 17, 18, and 19 were thrown out and resown on July 3rd, soil No. 2, free from chlorides, being used and no fertiliser added. They received sodium chloride as follows :—

No. 16, ·02 per cent. NaCl
„ 17, ·05 „
„ 18, ·10 „
„ 19, ·20 „

Notes were made of the appearance of these pots on July 24th, and again on August 26th.

No. 16 had germinated well; growing well; heads are forming, October 8th.

No. 17, germination slightly retarded, but recovered and growing well.

No. 18, germination considerably affected; poor in appearance (July 24th), but recovered and growing well (August 26).

No. 19, germination much affected; growth very feeble. Plants dead. (August 26.)

A further set of pots was resown on July 28th with the following quantities of salt:—

Pot No. 24, ·10 per cent. NaCl
„ 27, ·15 „
„ 30, ·20 „
„ 31, ·30 „

On August 26th these pots presented the following appearance:—

24, germination retarded.
27, germination more retarded.
30, germination very feeble.
31, very few germinated.

From the above experiments the following summary of conclusions is drawn:—·01 to ·02 per cent. common salt is without effect upon the wheat plant, the grain germinating well, and the plants growing vigorously. With ·05 to ·10 per cent. the germination is somewhat retarded; the plants are less vigorous but recover and grow well. With ·15 the germination is still more affected, and the plants would probably not recover under less favourable conditions than those of the experiment. ·20 per cent. common salt in the soil is fatal to the growth of wheat.

## Experiments with Sodium Carbonate.

Sodium carbonate is present in the water of many of the artesian bores in New South Wales. As these waters constitute, in many cases, the only available supply for irrigating, the question of the limit of tolerance of different crops for this alkali is one of considerable importance.

When water charged with alkali is used for irrigating, the soil frequently becomes covered with a white crust, consisting of sodium carbonate. This is due to capillary action, which brings the alkali to the surface, where it is left as a deposit on evaporation of the water. When the amount of alkali present is considerable, the soil becomes quite hard, and tillage operations are rendered very difficult, and in some cases impossible. These conditions were not reproduced in the experiments, the surface of the pots being covered by a mulch, so that surface evaporation was reduced to a minimum, the soil was always moist, and the drainage effectively prevented the accumulation of water or of water charged with alkali. The experiments, therefore, represent the action of the alkali upon the plant itself, without reference to its possible deleterious effects upon the soil.

Pots were filled with soil No. 1, and fertilised and sown on June 3rd in the manner already described. The following pots were prepared:—

Pot 21, ·01 per cent. $Na_2CO_3$ (Sodium carbonate).
„ 22, ·05 „
„ 23, ·10 „
„ 24, ·50 „
„ 25, 1·00 „
„ 26, 3·00 „

On July 1st, the appearance of these pots was as follows:—

Nos. 21 and 22 had germinated well; growing well (grain in the ear, October 8th.)
No. 23 had germinated well; not quite so vigorous; backward (grain not forming, October 8th).
No. 24, germination weak; plants very puny; had died by July 24th.
Nos. 25 and 26 did not germinate.

Pots 25 and 26 were resown in No. 2 soil on July 3rd with ·2 and ·4 per cent. $Na_2CO_3$ respectively.

In pot 25, containing ·2 per cent. $Na_2CO_3$, the seeds germinated well and the plants were growing well on July 24th and August 26th; the heads were forming October 8th. In the pot containing ·4 per cent. $Na_2CO_3$ germination was much affected, and the plants were very feeble on July 24th, and had all died by August 26th. In the other pot, containing ·30 per cent $Na_2CO_3$, germination had been retarded, and the plants were less vigorous on August 26th.

The conclusions drawn are the following:—Quantities of $Na_2CO_3$ up to ·20 per cent. of the soil do not affect the growth of wheat in any way. With ·30 per cent. $Na_2CO_3$ in the soil germination is affected, with ·40 per cent. the germination is much affected, and the plants die. ·3 per cent. can, therefore, be regarded as the limit of endurance.

## Experiments with Ammonium Sulphocyanide.

Ammonium sulphocyanide is occasionally present in sulphate of ammonia, particularly in the product obtained from the commercial liquor of the gas-works. We have never came across it in any samples of sulphate ammonia manufactured locally, but its poisonous action is so much greater than that of the substances just discussed, that it appeared a matter of some importance to ascertain how much plants can stand.

The following pots were prepared, and filled with soil No. 1, and manured and sown as before on June 3rd:—

Pot 28, 0·01 per cent. $NH_4CNS$ (Ammonium sulphocyanide).
„ 29, 0·05 „
„ 30, 0·10 „
„ 31, 0·50 „

None of the above germinated, and the pots were resown on July 3rd with soil No. 2 (no manure added):—

Pot 28, ·001 per cent. $NH_4CNS$
„ 29, ·003 „
„ 30, ·005 „
„ 31, ·01 „

On July 24th, Pot No. 28 had germinated well, but growth was retarded, the plants were poor in colour, and the tips of the leaves were becoming yellow.

Pot 29 had germinated, but the plants were growing very feebly.

Pot 30 had germinated, the plants were very feeble, and apparently dying.

Pot 31 hardly germinated, and the plants had died.

On August 26th—

Pot 28 had recovered, and the plants were growing fairly well.

Pot 29 had also recovered, and was growing fairly.

Pot 30, all the plants were dead.

The conclusions drawn are the following:—·01 per cent. of ammonium sulphocyanide in the soil prevents germination, quantities as small as ·001 per cent. seriously affect the growth of the plant, which, however, under favourable conditions may recover. ·005 per cent. is fatal to the growth of the plant.

## Experiments with Sodium Chlorate.

This ingredient is sometimes present in nitrate of soda. The following experiments were carried out to ascertain the proportions of this substance which the wheat plant can tolerate without being injuriously affected.

The following pots were prepared, filled with soil No. 1, and sown on June 3rd:—

Pot 32, ·01 per cent. $NaClO_3$ (Sodium chlorate).
„ 33, ·05 „
„ 34, ·10 „
„ 35, ·50 „

With the exception of 32, none of the seed in the above pots germinated. In No. 32 the seed had germinated, but the plants were very feeble, and were all dead when examined on July 1st.

The pots were, therefore, resown on July 3rd with soil No. 2, the following quantities of sodium chlorate being added:—

Pot 32, ·001 per cent. $NaClO_3$
„ 33, ·003 „
„ 34, ·005 „
„ 35, ·01 „

In Pot No. 35 the seed germinated as with pot 32 in the preceding experiment, but the plants were very feeble, and by July 24th they were all dead.

Pot 34, the seed germinated but growth was feeble, and plants were dying when examined on July 24th and died subsequently, being all dead by August 26th.

Pot 33, seed germinated but plants were growing very feebly on July 24th and August 26th.

Pot 32, the seeds germinated well, the plants on July 24th were weak and slightly discoloured. By August 26th they had recovered and were growing fairly.

The conclusions drawn are the following:—Germination is not seriously affected until the amount of sodium chlorate in the soil approaches ·01 per cent., but the subsequent growth of the plant is injuriously affected by so small an amount as ·001 per cent. and the limit is exceeded at ·003, at and above which quantity the presence of sodium chlorate is fatal.

## Experiments with Arsenious Acid.

Since the recent enquiry in England into the cause of wholesale poisoning by beer, which revealed the fact that the glucose used for brewing frequently contained arsenic traceable to the pyrites and sulphur used in the manufacture of sulphuric acid, attention has been directed towards the possibility of this ingredient being present in other substances which are used commercially.

Amongst these must be counted fertilisers compounded of superphosphate in the preparation of which sulphuric acid is employed. If the ingredients employed in the manufacture of the acid are not free from arsenic, this substance will be present in the resulting fertiliser. It is known to have an injurious effect upon the growth of plants, and the following experiments will indicate its effect upon wheat.

The following pots were sown on June 3rd in No. 1 soil, the complete fertiliser having been added, together with varying amounts of arsenic trioxide:—

Pot 37, ·01 per cent. $As_2O_3$ (Arsenious acid).
„ 38, ·05 „
„ 39, ·10 „
„ 40, ·50 „
„ 41, 1·00 „

Pot 37, germinated well, plants not affected and growing well on July 1st and 24th, and were growing well on August 26th; grain is now forming in the ear, October 8th.

Pot 38, germinated well, but early growth not very vigorous, plants growing fairly August 26th; grain is in the ear October 8th.

Pot 39, germinated fairly well and plants growing fairly on July 1st, subsequent growth poor and weak; October 8th grain is forming in the ear, but plants are very stunted and grain backward.

Pot 40, germination poor, plants very puny (July 1st), and almost dead by July 24th, still alive and very feeble by August 26th, all dead by October 8th.

Pot 41, germination and early growth very feeble, plants nearly dead by July 24th, all dead by August 26th.

The conclusions drawn are as follows:—Germination and early growth is affected by the presence of ·05 per cent. arsenic in the soil, the injurious effect increasing as the proportion of arsenic becomes greater; with ·1 per cent. arsenic the plant does not come to maturity. The presence of ·01 per cent. arsenic is without injurious effect upon the growth of the plant.

The following table summarises the results obtained.

EFFECTS upon Germination and subsequent Growth of the Wheat Plant of different percentages of injurious substances in the soil.

| | Germination Affected. | Germination Prevented. | Growth Affected. | Growth Prevented. |
|---|---|---|---|---|
| Common salt ... ... | ·05 | ·20 | ·05 to ·15 (recov.) | ·20 |
| Sodium carbonate ... | ·30 | ·5 to 1·0 | ·10 | ·40 |
| Ammonium sulphocyanide | ·005 | ·01 | ·001 | ·005 |
| Sodium chlorate ... ... | Above 0·1 | ·05 | ·001 | ·003 |
| Arsenious acid ... ... | ·05 | Above 0·5 | ·05 | ·10 |

Attention must be drawn to the fact that in these experiments the injurious substances were incorporated with the soil prior to planting, and that there was no accumulation of them in any one place. In actual practice the fertilisers which are liable to contain these deleterious ingredients are applied in such a way that they are concentrated in the first few inches of the surface soil. This is especially the case when the fertiliser is drilled in with the seed, in which case they are concentrated in the immediate neighbourhood of the germinating seed. For example, ·2 per cent. sodium chloride in the soil was found in the above experiments to be absolutely fatal to the growth of wheat. This amount represents about 5,000 lbs., or nearly 2¼ tons of salt distributed over an acre of soil of average weight to a depth of six inches. Such a dressing would not be applied in practice, but the same injury would result to the plant if the few founds of soil in its immediate neighbourhood, and from which it draws its food supply, were charged with salt to the same extent.

# New Breeds and Varieties of Fowls.

(Continued from vol. xiii, p. 1197.)

G. BRADSHAW.

## Anconas as Egg Producers.

As previously said, poultry are kept for one of two purposes, or both. The primary object, however, is and always has been with the idea of making money, it being generally accepted that after purchasing the proper food for a fowl or fowls and supplying it in suitable quantities, coupled with other intelligent management, this fowl or fowls will give in return a quantity of eggs per week, month, or year, which when put in the market will realise sufficient to pay for the food and labour and leave a surplus for the owner. This has been briefly termed poultry keeping for eggs. Another branch of the business frequently associated with this is rearing chickens for the market, many people such as suburban residents, fruit growers, and farmers, who keep many or few fowls as a sort of auxiliary to their other business or trade, breeding both for eggs and meat. In the spring months eggs are usually the cheapest, and this is the best time for breeding and rearing for the market. For this purpose certain breeds of fowls are more suitable than others, but as previously stated, laying is not so much a matter of breed as of strain; on the other hand, certain breeds are much more profitable than others when carcases for market is the object. Breeding for eggs, or egg farming, is practised by a great many in this State. These people may be called specialists from the fact that they make this the sole object of their operations, and in the majority of cases it is the most remunerative branch of poultry keeping. Some of these breeders keep one or two varieties of pure-bred fowls, others have some special cross from which they get satisfactory results, but all try for and the majority accomplish the production of eggs all the year round, for, as is too well known, while any old hen will lay in the spring when eggs are cheap, the majority cease producing when eggs are at their dearest. Egg farming, as a rule, when practised on intelligent lines, pays better than when breeding chickens are included in the business, the chief reason being that the returns are much quicker, for as soon as the eggs are produced they can be marketed, in fact the shorter the time from the point of laying till marketed the better, new-laid eggs always being sought after in greater quantities than they can be supplied, whereas if chickens are hatched they require some months of feed, care and trouble—if reared at all—before they be brought to market. A good hen will lay a dozen eggs in a fortnight, worth 1s., while an ordinary chicken is only worth that amount at the end of about a couple of months or more, and during that time will have eaten as much food as it took to produce the eggs, together with other expenses, care and trouble, and the owner lying out of his capital for the longer period. This brings me to the crux of the question: To which of these branches of poultry-keeping are Anconas most suited? From the experience of the numerous English and local breeders there cannot be much difficulty in arriving at a decision, every reference to the breed pointing to its one special feature—that of being generous egg-producers.

The earliest mention of them is that they belong to the Spanish race of fowls, and more than a hundred years ago this race had the credit of being wonderful layers, and a table published in the English *Agricultural Gazette*, as far back as 1852, gives details of four birds of this breed, hatched on April 10, which commenced to lay on December 7, and produced for the twelve months 928 eggs, or 232 for each hen, a record which if correct puts in the shade any of our present-day breeds or strains. In 1854 Martin Doyle concludes his description of this breed by saying:—"They possess the general characteristics of the Spanish race, and are excellent layers." In 1868 they are described by John Baily as being prolific layers, and to produce unusually large eggs. Another writer of the same period stated that they were very hardy and with no end to their laying. The next record is that attaching to those imported by Captain Rowle, the same generous laying attribute still attaching to the breed, which brings us down to the Anconas of modern times. The several English writers' testimony, which appeared in the previous portion of this article, that the characteristics attached to the Spanish race of fowls a hundred years ago has remained unimpaired in the Anconas until the present day is confirmed by modern writers, who specially mention them as excellent layers.

It may, however, be protested that the attributes for which the breed is celebrated may be largely due to environment or climatic conditions, and while doing well, as has been shown in England, they may be a failure or partially so in this country. The evidence, however, is satisfactory. At Greta, 130 miles north of Sydney, the importer there has stated that with him Anconas are very good layers of fine white eggs, over the average size and much larger than the Orpingtons. At Penrith they averaged 165 eggs a year per hen, not the laying of one hen, which is a very different matter, for among a flock of admittedly bad layers of any breed there may be an individual capable of the above record, but when a flock of hens lay over thirteen dozen eggs each in the twelve months, their value becomes apparent to the poultry-breeder who makes this the principal branch of his operations.

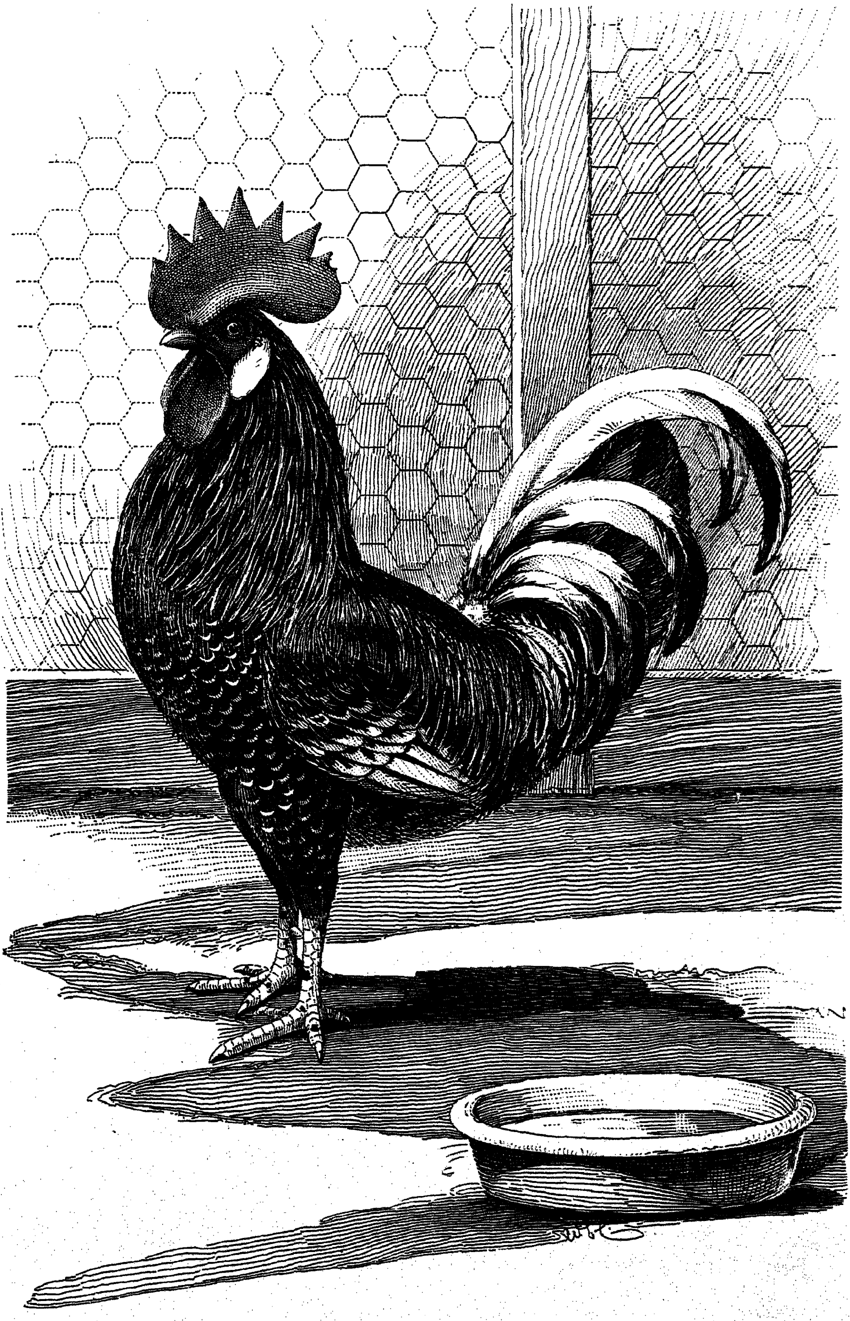
During the year in question, eggs averaged over 1s. a dozen all the year round, this revenue of 13s. each from a yard of hens being the most eloquent evidence in favour of the belated hen. In connection with these articles, I had purposed going lengthily into the various methods and cost of feeding fowls in relation to egg-production, but as other and not less important breeds await treatment, I must defer the feed question for future extended reference, except at present to say that people need not run away with the idea that the above 13s. is all profit, the food bill for a year such as this is a big item in reducing the profits from any kind of stock. In normal years a hen's keep is approximately 1d. a week, or say 4s. for the twelve months, and, as is too well-known the present year the above food account will have to be doubled, which would leave about 5s. a year profit on each hen; this, however, will be increased by the fact that the present year's average for eggs will be considerably above the normal. Reverting to the Anconas, an importer at Moss Vale, with conditions, temperatures, &c., totally differing from those up north, says: "I have found them excellent layers, particularly towards the end of winter." Another breeder in the same district says they are good layers of very large eggs, three of the hens laying larger eggs than Minorcas. The Victorian (Gippsland) correspondent, Mr. J. F. Travers, has had a similar experience, as follows:—"I brought the Anconas out with me from England now nearly two years ago, and have found them excellent layers. The chickens are very hardy and precocious, and learn to look after themselves at a very early age; the majority I have reared in foster mothers. The birds are certainly wild but soon get to know the person who tends them, and are quite tame with them, but if a stranger goes amongst them they are easily scared. The eggs are scarcely so large as those of some other breeds, but are not small. The demand for the birds and eggs so far has not been very large but it is improving, and their great laying qualities should soon bring them to the front."

The above opinions are overwhelmingly conclusive that, unlike some of the other breeds, Anconas are to-day celebrated for the very same properties for which they were distinguished nearly a century ago, and, whatever may result in the future, there is no evidence so far that actually bad-laying strains have developed, and this, despite the fact that, of the two lots of this breed which competed at the College, one was low in the contest, still they were two pens ahead of the celebrated Minorcas, one of Andalusians, and one each of Wyandottes and Orpingtons, and as the competition is being continued for a further term, the full year's record will be of much interest as showing how they come out in winter production, as is claimed for them by several patrons. At the same time, there is a fear evinced that Anconas may go the way of many other breeds, namely, deteriorate in useful qualities. The following extract on this subject by Mr. E. Cobb, an English poultry expert, is taken from the second edition of "Profitable Poultry," which may be had on application to the Department of Agriculture: "Those who launch the Ancona as an exhibition fowl will only have themselves to blame if in years to come it has lost that for which it is now recommended; but being launched, and having taken the hold that it has on the fancy, I am of opinion that it will pay the fancier more profit if it only lays one hundred instead of as at present two hundred eggs a year, and that by the time this does happen another breed will be found to take the utility place vacated by the Ancona." That this danger is apprehended by some of our own breeders will be seen from Mr. Lurcock's communication, which concludes with the following: "I think when they become more generally known they will be more sought after as a utility fowl, that is, if breeders do not sacrifice their utility qualities for show points which I do not intend to do."

Prior to the introduction of this breed to Australia it was generally understood that as the fowls were small the eggs were naturally so. Such idea has, however, with many others, received a rude shock by the result of the six months' contest at the College. Of the forty-one pens competing there were two of Anconas, both owned by breeders who have contributed their experience to this article. One of the pens finished sixth in the competiton, leaving thirty-five pens behind; but more remarkable, the 444 eggs laid by these smallish fowls were heavier than the 451 laid by Buff Orpingtons and 469 laid by White Leghorns and thus secured the third prize for the greatest weight of eggs, the 444 weighing exactly 60 lb., the market value of which was £2 17s. 4d. The eggs from both pens in the competition weighed twenty-six ounces to the dozen, thus setting at rest all theories or opinions relative to size. I must now revert to a peculiarity of Anconas which is puzzling, and which with some poultry-keepers would be a rather severe handicap—I refer to the innate wildness of the breed, the majority of the old country breeders agreeing with those in Australia as to this peculiar trait. "Very wild," "Fly like magpies," "Scoot away on the approach of strangers," and other terms are used by various breeders, but all admit that with careful treatment they become as tame as any other breed, and particularly so with those who tend them. In conclusion, it will be seen from all the above testimonies and experiences that this variety of fowls are celebrated for egg production only—no end of laying, lay well in winter, and big eggs,—hence for those who make egg farming the principal branch of their poultry business this breed of fowls should be most satisfactory, and here it should be made clear that they must not be classed as meat-producers, being simply generous layers, hardy, and inexpensive to keep through being small feeders.

## Judging Anconas.

To the end of keeping and breeding of fowls pure, certain standards for type, colour, and other points are laid down; the fowls coming nearest these standards being considered the best from an exhibition point of view, and as the majority of breeders who import here desire to exhibit them, such was done by several of the Ancona enthusiasts, but, as in the case of most breeds new to judges, dissatisfaction has been frequent. Possibly the greatest hardship was that experienced at the first show in Australia where this breed was exhibited. A pen each of Anconas and Spangled Orpingtons were brought direct from the steamer to the showroom. Both breeds being new to the stewards, the Anconas were placed in the Orpington pen, and the Spangled Orpingtons in the variety class. The blunder was further emphasised but not unsatisfactorily by the judge awarding both lots prizes. The judge's attention was drawn to the matter, but it was then too late for correction, and as he said they had both got prizes, and, as not a dozen people in the show



AN EXHIBITION ANCONA COCKEREL.

knew one from the other, there was not much harm done. Anconas are, however, now fairly well known, and although several of the breeders in their communications expressed dissatisfaction at many of the awards, as the breed becomes better known judging will be more in accordance with the standards. The most frequent mistakes have been in relation to colour. They are a black fowl with a white V-shaped end on each feather; this should be the colour throughout, and the more even the spangling the better: quite a number of the birds come with too much white. On this subject Lewis Wright says:—"If one wishes to produce really good exhibition specimens it is much better to breed from two hens and a cock which have the qualifications to breed standard birds, than a field full of so-called Anconas of the old "Splashed-anywhere-you-like birds," which give one the impression that they have been splashed with a white-washer's brush."

The illustration of the Ancona cockerel which accompanies this article is of the true exhibition type and markings, and which, with the appended English Poultry Club's standard should leave little excuse for erratic awards in the future.

## Standard for judging Anconas.

### *General characteristics of Cock.*

*Head:* Deep, moderate in length, rather inclined to width, carried well back. *Beak*: Medium. *Eye*: Bright and prominent. *Comb*: Single, medium, upright, with deep, broad, even serrations (five to seven) forming a regular curve; coming well back and following line of head, free from excrescences. *Face*: Fine in texture, free from creases. *Ear-lobes*: Medium, inclined to almond shape; free from folds. *Wattles*: Long, fine in texture; in proportion to comb. *Neck*: Long, nicely arched, well covered with hackle. *Body*: Broad, tapering to tail, close and compact. *Breast*: Full and broad, carried well forward and upward. *Back*: Moderate length. *Wings*: Large, carried well tucked up. *Tail*: Large and full, carried high, with fine flowing sickles. *Legs and feet*: Thigh not much seen. *Shank*: Medium length, strong, set well apart, clear of feathers. *Toes*: Four, rather long and thin, well spread out. *General shape and carriage*: Alert, bold, active. *Size and weight*: Medium, full-grown birds from 6 lb. to 7 lb.

### *General Characteristics of Hen.*

*Head*: Moderate length, rather broad. *Beak and eye*: As in cock. *Comb*: Medium, falling on one side, single fold preferred, partly hiding face; free from excrescences, broad serrations fine in texture. *Face*: As in cock. *Ear-lobe*: Medium. *Wattles*: Medium length, well rounded, fine in texture. *Neck*: Medium length carried well up. *Body*: Round and compact, rather longer than the cock. *Breast*: Full and prominent. *Back*: Rather long and broad. *Wings*: Large, carried close to body. *Tail*: Full, carried well up. *Legs and feet*: As in cock. *General shape and carriage*: Lively, active. *Size and weight*: Medium from 5 lb. to 6 lb.

### *Colour in Anconas.*

In both sexes.—*Beak*: Yellow, with black or horn-colored shadings. *Eye*: Bright red. *Comb, face and wattles*: Bright red. *Ear-lobe*: White. *Plumage*: Good beetle-green ground, tipped with white, as evenly mottled throughout as possible, with no inclination to lacing. *Legs*: Yellow, mottled with black.

Value of points in Anconas.

| *Defects.* | Deduct up to |
|---|---|
| Defects in comb | 10 |
| ,, eye | 5 |
| ,, lobes and wattles... | 10 |
| ,, colour | 30 |
| ,, legs and feet | 10 |
| Want of size | 15 |
| ,, condition | 10 |
| ,, shape and symmetry | 10 |
| A perfect bird to count... | 100 |

*Serious defects* for which birds should be rejected: White face, plumage other than black and white, wry tail or other deformity, legs other than mottled, other than four toes.

It may be mentioned that there are now rose-comb Anconas, and also Bantams, the colour of both to correspond with above.

## BOTTLING APPLES.

In answer to an inquiry for information as to the method of bottling apples, the Fruit Expert reports:—Apples for bottling should be pared and cored, the bottles then packed as full as possible with the fruit. Syrup, made in the proportion of 2 lb. to 4 lb. sugar to the gallon of water, having been previously boiled for twenty minutes, strained, and allowed to cool, should then be poured over the fruit until the bottle is full, when the top should be screwed down without the rubber. The bottles should then be placed in a copper, with a flat board or a sugar-bag under them to prevent their coming in contact with the metal, and small pieces of wood placed crosswise between the bottles to prevent their touching each other. Fill the copper with cold water until the bottles are about three parts covered, then bring to a boil gradually, and cook for fifteen minutes. Then remove the bottles, take off the tops, and place the rubber bands on the bottles; fill to overflowing with boiling syrup reserved and kept boiling for the purpose, replace the tops, and screw down tightly and set aside to cool, but do not allow a draught to get on them. There should be no trouble in preserving apples in this way if care is taken not to let the water go off the boil after once it has started.

# About Eggs.

G. BRADSHAW.

THAT product of domestic poultry and common article of food—the familiar egg—has always been highly esteemed as a delicate, agreeable, and nutritious diet. Eggs are prepared in various ways, and enter into the composition of many dishes either alone or in combination with other articles. They vary in size, colour, and quality almost as much as the poultry that produce them. In connection with hens' eggs the size of the fowls does not govern that of the eggs they produce, this being a matter more of breed, and occasionally families of the same breed have peculiarities in respect to the size of the eggs they lay. Speaking generally, what is known as the Mediterranean or non-sitting breeds lay larger eggs than do the Asiatics, the enormous Buff Cochin fowl being credited with the smallest.

The breeds also govern the colour of the eggs, the Asiatic sorts laying the various shades of the much admired brown, while all the varieties included in the Spanish race produce those with white shells, as do the majority of the French breeds, such as Houdan, La Fleche, Creveceurs, Le Mans, &c. This colouring is so true an index of the race that when an occasional Leghorn or Minorca lays a tinted egg it is pretty safe to say that she has some Asiatic blood in her veins. A peculiarity is worth noting here, namely, that while most breeders have had experience of an apparently purebred bird of the Spanish race laying a tinted egg, it rarely happens that an Asiatic fowl produces an absolutely white one.

As to what governs the colour and shape of eggs, ornithologists have advanced more than one opinion; however, for the present purpose it is safer to acknowledge ignorance than hazard speculative theories. Suffice to say that nature's law controls the character of the birds' plumage, as it does the size, shape, and colour of their eggs, and that the shape and colour is no mere accident, but possibly a provision for the protection of the species or other wise cause. Concerning the weights of eggs—take a given number of white eggs and brown, irrespective of the breeds of fowls which produce them, Hamburgs excepted—those with the white shells as a rule weigh the heavier.

Coming to quality, it was a long-entertained idea that the colour of the shell had something to do with the quality of the contents, brown-shelled eggs being assumed to be richer in nutriment than those with a white covering; this assumption is now becoming dispelled. Several of the United States Experimental Stations some time ago went into the subject thoroughly, the result of the exhaustive experiments determining that the colour of the carbonate covering was no key to either flavour, nutriment, or other quality. That there are eggs rich, and others weak, in nutritive ratio is true. This, however, is the result of feeding, and the condition under which the fowls are kept; soil, climate, environment, and food all contributing to the fact that eggs vary in the several essentials which constitute them a nourishing and palatable food; and, taking them all in all, analytical chemists contend that weight for weight eggs contain more nutriment than any other of our ordinary foods, the only waste portions being the shell and water, the percentage of the latter being a mere fraction.

## Composition of the Shells.

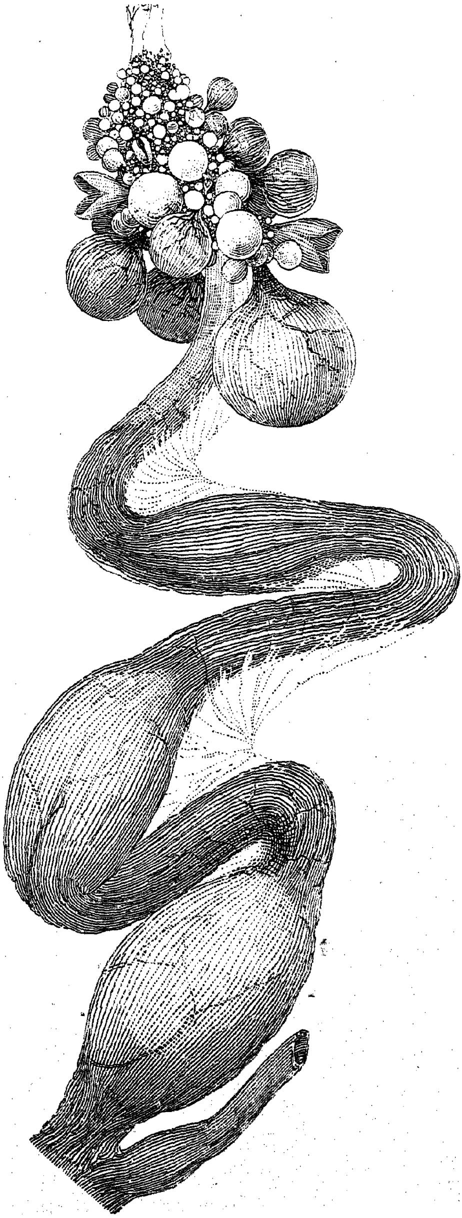
Although eggs are a very common article of food there is not a very general knowledge amongst poultrymen as to their formation, &c. The shell or envelope is white or coloured according to the breed which produces it, and is composed of carbonate of lime, phosphate of lime, and animal gluten; salts of lime causing the particles to adhere. Soft eggs are either eggs without a shell, or the shell may be so thin as to feel soft through the deficiency of salts of lime. It is a matter of surprise where a hen finds all the lime necessary, for if she lays 150 nominal sized eggs in the year she will have produced 2 lb. of pure carbonate of lime. Mr. P. L. Simmonds, F.L.Z., on this subject in the *Journal of the Society of Arts*, says :—"If a farmer has a flock of 100 hens, they produce in egg shells about 137 lb. of chalk annually, and yet not a pound of the substance, or perhaps not even an ounce, may be found on the farm. The materials for the manufacture are found in the food consumed, and in sand, pebbles, brickdust, pieces of bone, &c., which hens and other birds are continually picking from the earth. Their instinct is keen for these apparently innutritious and refractory substances, and they are devoured with as eager a relish as the cereal grains or insects." If hens are confined to barns or outbuildings, it is obvious that the egg-producing machinery cannot be kept long in action, unless materials for the shell are supplied in ample abundance. If fowls are confined in a room and fed with any of the cereal grains, excluding all sand, dust, or earthy matter, they will go on for a time, and lay eggs, each one having a perfect shell made up of the same calcareous elements.

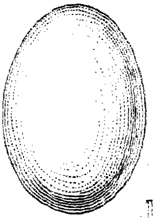
A distinguished chemist confined a hen for ten days and fed her exclusively upon oats, of which she consumed 7,474 grains in weight. During this time four eggs were laid, the shells of which weighed nearly 400 grains. Of this amount, 276 grains were carbonate of lime and 10 gluten.

The object of this experiment was to test the reserve stock of shell substances in the hen's body at the time of confinement, as oats are very deficient in carbonate of lime. The hen discontinued laying, hence the conclusions were not definite, but it was thought, had she continued laying for a time, the eggs would have become shelless, or almost so.

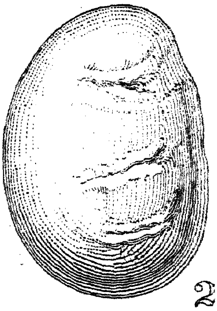
The shell is porous to such an extent that when examined by a microscope it has quite a sieve-like appearance, and is permeable by the air, otherwise the chicken could not live during the incubating period.

This porosity of the shell, although absolutely necessary when the eggs are to be incubated, is detrimental when such have to be used as an article of food, from the fact that by means of these minute

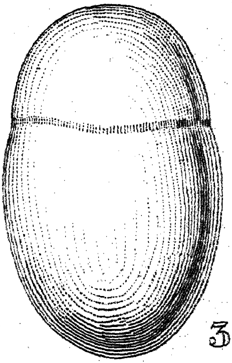




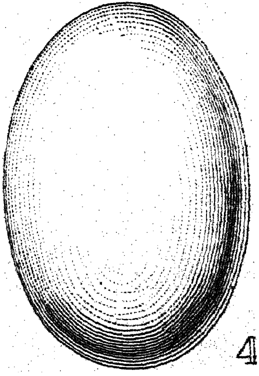
1



2



3



4

perforations there is a continual evaporation, so that from the time the eggs are laid until consumed there is a wasting and deterioration of the contents, the extent of which is dependent on the temperature and other conditions under which they are kept, it being very well known that eggs deteriorate much quicker in summer than in winter—this fact being in evidence in our local markets throughout the year, northern eggs being always at a lower quotation than those produced south of Sydney—and it is the knowledge of this that prompts the preservation of eggs. The main point in all the various methods is an attempt to seal up these pores, and thus retard or completely stop the evaporation.

This evaporation and source of decay has, through latter day experiments, become from a commercial point of view of much less import than formerly, it being now overwhelmingly demonstrated that in a temperature reduced to freezing or a few degrees below that point eggs will keep an almost indefinite time, and it should be here said that although still water will freeze at 33 degrees F., eggs will not do so. New laid sorts can be safely kept from 28 degrees up without fear of the frost cracking the shell, while those of a few weeks old before storing will stand a lower temperature, this resulting from the fact that, owing to the evaporation, there is more room for the contents to expand by freezing without bursting the shell, hence the generally accepted theory that freezing eggs will crack them is but partially correct, there being now in the Government export stores at Darling Harbour a quantity for experimental purposes without a flaw and as hard as a rock, and they have been there for the past three or four years.

Concerning this system as a preventive of decay, in 1897, before cold storage was thought of here or practically entertained, I wrote the following in the *Gazette*, and the predictions, although then freely criticised, have now to the fullest extent been realised:—

"However practicable any or all the systems may be, the freezing chamber or cool method is for all purposes the best. The only thing to do is to pack the eggs in boxes or other receptacles, and keep in the cool chambers, at a temperature slightly above freezing point, and there is no further trouble. With this temperature the eggs can not only be kept an interminable time, but can be sold as new laid and fetch top market price. Nor is there any deception in describing them as such, for in a temperature as mentioned everything in the egg is held in suspense. There is no process of decay; consequently they retain all their original qualities, which cannot be said of those treated by many other processes. The one great handicap to this plan is that it cannot be generally adopted from the fact that there are at present no cold storage chambers with a proper and continuously regulated temperature; and were there such, and a moderate charge made, I feel sure they would be well patronised; nor need there be any doubts as to the nature of the results. Possibly the most important and interesting circumstance in connection with the cold storage of eggs is the fact of a complete suspension of the manifestations of life, and the reversal of this when placed under a hen after many months in the cold stores. Should the temperature fall below 30 degrees, and the eggs freeze, all vitality will then be destroyed; but if over 32 degrees and under 40 degrees, eggs five months old have been known to hatch; and how long this vitality can be held in such suspense has not yet been determined. Before leaving this subject I should observe that the possibilities of the egg trade, through the instrumentality of cold storage, are very great, and I look forward to the time when huge quantities will be stored in this way during the cheap season, and kept until the scarce time, which would do much to restore an equilibrium in the summer and winter prices, and still further assist in making poultry breeding as valuable an adjunct to the farm as it should be."

No sooner had the *Agricultural Gazette* containing the above extract got distributed than inquiries began to arrive at the secretary's office about the practicability of the new system. The majority of the correspondents, while placing faith in the statement of cold air being a perfect preservative, hesitated to subscribe to the remark that the eggs could be kept an interminable time, while a few doubters pronounced the thing a theoretical fad, and recited authentic instances where the cold process had been tried in city establishments, resulting in absolute failure. Happily, however, during the time these discussions were going on, experiments were being conducted at the Government Cold Stores, the result warranting the Board for Exports placing a cool chamber, regulated to the proper temperature, at the disposal of farmers and others wishing to test the possibilities of this hitherto closed road to the rightful earnings of their flocks.

The confidence of the producers in this system, untried prior to 1898, was evidenced during the past year, the Secretary to the Board for Exports showing in his last annual report that for the season there were stored at the export depôt 4,008 cases, numbering 144,288 dozen —or nearly one and three-quarter million—eggs, the majority of which were stored in September and October, and delivered in their original state during the following April, May, and June. That many of these were not, nor could not, be sold as absolutely new-laid arose not from any fault of the system, which cannot be more perfect, but rather from the fact that in some instances two or three weeks elapsed from the time they were laid until stored.

It may be here mentioned that many million dozen of eggs are stored annually in the great cold rooms of New York, Chicago, and other big cities of the United States, but in every instance provision is made for turning the cases weekly or monthly, with the object of preventing the yolks from adhering to the shells by being allowed to remain too long in one position. The system as in operation at the Government cold stores, Pyrmont, obviates all the above labour, and from the time the case or cases of eggs are placed in position in the cold rooms, they are not moved in any way until such time as they are required by the owners, whether the interval is the unusually short one of a few weeks or the more regular period of five or six months. Another theory which obtained in the early days of cold storage was to the effect that all eggs should be packed with the large end down; and although a few depositors still pack them in that position it is now placed outside the region of doubt that the labour involved in doing so is lost; it does not matter a snap whether the eggs rest on either side or end. If fresh when stored and kept in the proper thermometric and barometric conditions they undergo no change. The barometrical conditions are the most important, and to these being faulty is due the great losses which resulted a few years ago in more than one city cold store.

## Formation and Production of an Egg.

Anyone, upon opening after death the body of a hen, will find a cluster of eggs in formation much like a bunch of grapes, and called the ovarium (see plate). These, however, are but rudimentary eggs, and I have counted as many as seventy in one bunch, and are in size from a pin's head to the full-sized yolk of an egg. Each of these eggs is contained within a thin transparent sac and attached by a narrow pipe or stem to the ovary, and during the laying period of the hen these eggs are maturing and thus keeping up the supply which she lays. These rudimentary eggs have neither shell nor white, consisting wholly of yolk, on which floats the germ of the future chicken; and as they become larger and larger they arrive at a certain stage when, by their own volition, weight, or other cause, they become individually detached from the bunch and fall into a sort of funnel leading into a pipe or passage way called the oviduct—this organ in the hen being from 22 to 26 inches long. During the passage of this egg or ovum to the outer world it becomes coated with successive layers of albumen—the white—which is secreted from the blood-vessels of the oviduct in the form of a thick glairy fluid, and is prevented from mixing with the yolk by the membrane or sac which surrounded it before it became detached from the cluster. It is also strengthened by a second and stronger membrane, formed around the first immediately after falling into the funnel, and having what is like two twisted cords of a more dense albuminous character, called by anatomists chalazes, which pass quite through the white at the ends, and being, as it were, embedded therein, thus preventing the yolk and germ from rolling about when the egg is moved, and serving to keep the germ uppermost, so that it may best receive the heat imparted during incubation.

It is during the passage of the egg through the lower part of the oviduct that it gets covered with the two skins which are found inside the shell. These, although lying close around the egg, at the thick end become separate, and form what is called the air-bubble or chamber. This, in newly-laid eggs, is a mere speck, and is that portion which shows the result of the evaporation previously referred to. This speck of air space becomes daily larger as the eggs get older, and is frequently equal to one-fourth of the entire egg. This egg-chamber, if perforated with the finest needle, will prevent the egg hatching. When the egg has advanced more than half-way down the oviduct, it is still destitute of shell, which begins to be formed by a process of secretion, and when about completed the various shades of brown and tinted colouring matter is imparted in those breeds in which coloured eggs are peculiar; sometimes in very brown eggs white spots appear, but which can readily be rubbed off. When the shell and colouring is complete, the egg continues to advance along the oviduct till the hen goes to nest and lays it.

Eggs are produced from the surplus foods, which is that over and above what is required for the sustenance of the hen, and if such is too stimulating, or given in excessive quantities, the result is that in the former case the ova are produced so rapidly that sometimes two of them drop into the oviduct together, which results in the eccentricities which frequently puzzle the poultry-keeper. These ova travel together along the passage and receive the white separately, but become enveloped in one shell, and when laid are commonly known as double-yolked eggs, but more properly it is a double egg, the white being duplicated as well as the yolk. Should these yolks be fertilised and the egg hatch, we get the occasional four-legged or other chicken monstrosities. A further result of stimulating food is varied from the above when the ova mature in excess of one a day. In place of falling into the passage in pairs, as above, the two drop in separately but on the same day. This results in soft eggs, not from the want of shell-forming material, but rather because the shells cannot be formed as fast as the mature egg is ready for such covering. Crooked eggs are no uncommon thing in the poultry yard, and are attributable as follows: Twenty-four hours are usually sufficient for the formation of a perfect shell, but when by stimulation a second ovum falls close on its predecessor, reaching it before laid, the second egg, which is up to this time soft and is lying against the hard one, becomes covered with a shell, and when laid presents a flat or crooked side, the result of its position against the hard one.

To over-feeding is also attributable the further irregularity of one perfect egg being found within another, and caused by irritation of the oviduct, which, contracting in front of the perfectly-formed egg instead of behind it, forces it back until it meets another yolk, when the two join and again become coated with the white and the shell, thus producing another wonder. Other abnormalities are occasionally seen, and particularly in the small poultry yards. Sometimes when the ova are nearly exhausted by continuous laying, the secreting organs may be most active, which results in small marble-sized but perfect-looking eggs, which are merely a shell covering a portion of albumen. Such "eggs" when laid have the peculiarity of never having been at any stage attached to the ovary, but are a product only of the oviduct.

To the internal fatness of a hen is due other eccentricities than those mentioned, including the apparently paradoxical feat of laying rotten new-laid eggs, this being a not infrequent occurrence. The egg, being unable to force its way through the fatty oviduct, is retained two or three days near the mouth of this organ, and, if a fertilised one, the heat of the hen's body tends to putrefy it, and when ultimately laid it is in an addled condition. To other causes, but principally diseased organs, is due a departure from the normal in the way of colour. A hen which lays white or brown eggs, on rare occasions produces one almost black, while at other times these vagaries much resemble the dark green of the emu's eggs, and, in most instances, the shells are rough, wavy, corrugated, or otherwise irregular. Then there are the instances of foreign matter being found in eggs, clots of blood being nothing unusual. This is the result of the breaking of a blood vessel internally, and, again, possibly the effect of over feeding, a more pronounced case being that diagnosed by Dr. Cobb, and reported on page 1030 of the *Gazette*, 1902, and reproduced here:—

"The hen's egg sent contained several abnormal bodies having a somewhat clotted appearance and a reddish or brownish colour, and measuring 2 to 3 millimetres across. These bodies upon examination with the polariscope, combined with a chemical test, proved to contain numerous aggregations of carbonate of lime. From this fact I conclude that the walls of the egg-sack of the fowl producing the egg are in an unhealthy condition, accompanied by ulceration of the shell-secreting area. It would seem that some of the diseased portions, becoming detached from the shell gland, are included in the egg. Such appearances are not exactly uncommon in hens' eggs, but it is uncommon to find as many such bodies in a single egg as were found in the specimen submitted."

Fowls from whatever cause producing any of the above misshapen or otherwise faulty eggs should at once be got rid of, for although in some cases a reduced diet may bring them back to their normal production, still the slightest cause will frequently prompt the organs to their previous irregularities, the fowls thus becoming unprofitable members of the flock. As has been seen the majority of the troubles mentioned are preventable ones, and largely due to the poultry keepers' mistaken kindness in over feeding, but there are other ills of a more serious nature than those mentioned. The producing organs are of a most delicate nature, and, from the amount of work they have to do, are not only easily disarranged, but are subject to a variety of diseases, the nature of many of them being unknown to the ordinary poultry breeder.

Within the first five months of the past year, over 115,000 head of poultry were treated at the Export Depôt, and, as the internals of all these had to be removed before export, it can readily be seen that there were vast opportunities for investigation, and without pretending to much knowledge in defining the nature of the ailments it was apparent to those most innocent of pathology that from 5 to 10 per cent. of the poultry treated were subject to some form of disease of the reproductive organs. The field for investigation and research on these matters is so wide and the subjects so numerous that it is hoped Dr. Cobb may, in the near future, find time to diagnose a few of the important cases at present being preserved in the cold stores, and demonstrate to the poultry breeder the nature of the many diseases which have developed in latter day poultry keeping, and, by means of publicity in the *Gazette*, make known the successful methods to be applied in treating those members of the flock which are largely responsible for the aphorism that "poultry don't pay."

# The Stability of the Colouring Matter in Red Wines.

(Continued from page 62.)

M. BLUNNO.

Wines in general contain sulphates naturally in proportion of from 0·5 to 0·6 per 1,000. Any quantity up to 1 of sulphates per 1,000 of wine is considered to be normal, as it represents the proportion which the wine gets from the grapes, together with that caused by the rational treatment which must and wine receive through the different operations during and after fermentation, and in the after keeping.

The use of sulphurous fumes or of alkaline bi-sulphites, such as calcium and potassium bi-sulphites, which are employed to control fermentation and to ensure sound-keeping qualities, have as first effect the introduction of a certain amount of free sulphurous acid. Of this, a certain quantity is expelled through the action of the carbonic acid, which forms in great proportions during fermentation. A further quantity combines with the alkaline earth contained in the wine, and forms sulphites having a greater chemical stability than the original bi-sulphites; finally, sulphates will form, and they will go to increase the natural proportion of same contained in the wine.

The quantity of potassium bi-sulphite which is suggested in the foregoing with the view of properly conducting fermentation, and so obtaining good and sound wines from certain grapes, and under circumstances other than favourable to vinification, is calculated so that in no case the legal limit of sulphates is overstepped, such limit having been fixed by all the European legislation directed against wine-adulteration at 2 parts of sulphates, reckoned as neutral potassium sulphate, per 1,000 parts of wine.

The same, however, cannot be said for the quantity of free sulphurous acid and total ditto, that is, sulphurous acid free and combined together.

In Germany, Italy, Austria, and Switzerland the new legislation is very strict with reference to the two mentioned substances, whereby no wine should be sold that contains more than 20 milligrammes of free sulphurous acid, or 200 milligrammes of total sulphurous acid per litre (about 2½ pints). The same limit has been adopted in the Bill against adulteration of wines which has just become law in this State, and the proportions correspond respectively to 1·4 grains of the former, and 14 grains of the latter per gallon of wine. Some of the warmest advocates of a rather liberal use of bi-sulphites at vintage time are to be found in France, at the same time I note that in the French legislation on wines there is no restriction as to free or combined sulphurous acid, although there is a movement afoot in that direction. It is necessary, therefore, that wine-makers in this State should use sulphurous acid and its compounds with a greater discrimination than some French experts are now recommending.

The quantities of these two substances, to the extent suggested in the foregoing, might cause in some wines a greater proportion of free and combined sulphurous acid than the limits established by our law.

Wine-makers who under exceptional circumstances may have used or use these substances to such an extent as to have overstepped the already-mentioned maximum limits should be careful not to sell such wine for immediate consumption without having the wine analysed to ascertain the quantity of free and total sulphurous acid. If there be above 1·4 grains of the former, and 14 grains of the latter, per gallon, the wine should be blended with some other wine not containing any or containing a smaller amount of them, so that in the blend the proportions of the said substances will be within the legal limits.

## OTHER WAYS TO CONTROL TEMPERATURE OF WINE FERMENTATION.

The following is a *précis* of how to control the temperature during fermentation, independent of the use of sulphurous acid and bisulphites.

The alcoholic yeast, like all living organisms, has a minimum and maximum of temperature, within which it can exercise most of its energy; outside these limits it remains lethargic or dies. At 50° F. it is almost dormant, but its vitality increases as the degree of heat rises over 50° F.; it shows the maximum vitality between 77° F. and 86° F. Up to 92°-95° F., if the must does not lack fixed acidity, it is still in a condition of useful energy, beyond this its vigour is impaired, and if the yeast is kept for any time at 102° to 105° F. it secretes substances of denutrition. At this stage the original yeast can act no longer, nor could any other yeast specially sown, even if young and vigorous, continue the work left by the original leaven.

The wine-maker should, therefore, do all he can to keep the temperature of the fermenting must between 77° and 86° F.; up to 92° the wine is safe; above that, the quality must necessarily suffer.

The following ways to obtain this desideratum will not all be found suitable to the generality of growers, but among so many devices I presume everybody will find some means or other that will meet his case:—

For small vineyards grapes might be picked during the coolest hours of the day. I know of a vigneron, the Hon. Pavoncelli, at Cerignola (Italy), who turns out every year 2½ millions of gallons of wine, and who has, when possible, the grapes picked at night.

Grapes may be spread on a wooden or cement floor in a well-ventilated place and sprayed with water. The evaporation of the water will cool the grapes.

### *Acting on the Must.*

Immersion in the fermenting vat of a vessel containing a refrigerating mixture of ice and salt.—The use of ice alone was tried two years ago by Mr. J. Angus of Minchinbury, but the results did not come up to expectations. The same happened at one of the experimental viticultural stations in Southern Italy.

Fermentation in brick vats with as thin walls as possible, or with doubled walls allowing circulation of cold water, also vats built on the Monier system wrapped with bagcloth kept always wet.

Indirectly the temperature may be kept within limits by letting the juice of red grapes ferment by itself without the skins, *en blanc.* The skins are kept in a vat by themselves, well protected to prevent turning sour. When the must has fermented out its sugar, it is poured on the skins and kept until it acquires colour and astringency. In this case it will be necessary to draw the wine from the bottom of the vat and spread it over the top as often as possible.

Or, the must may be fermented with only half the ordinary quantity of skins. This is practicable in case of grapes very rich in colour.

Or, the must being fermented with the whole quantity of skins is withdrawn from the fermenting vat as soon as the temperature reaches 92° F. If the vigneron intends to follow this system he should keep the must and skins well mixed all the time by ramming down the heads as often as possible.

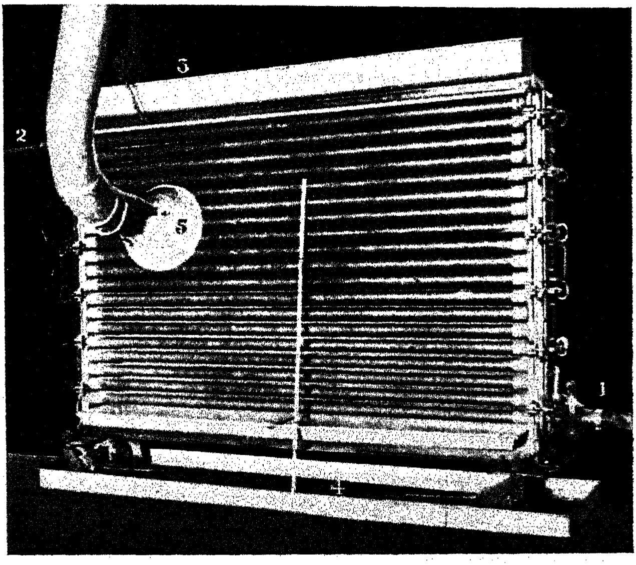
Again, the grapes crushed in one day are distributed in several vats, by having in each vat only a third of the quantity suited to its capacity. Next day the second third is distributed in this vat, and the third day the vessel is filled within 15 or 18 inches from the brim.

Many wines from rich musts, which, having fermented at very high temperatures, remain sweet, can be saved by properly watching them after they are removed from the vat and stored in casks. As soon as the temperature is down to 86° F. or so, the first pressing of skins derived from a vat, in which the temperature is kept within normal limits, is added to that wine. This pressing is rich in yeast rendered more active by the aeration that took place during the operation of pressing, therefore is apt to start the wine which remained sweet into a second alcoholic fermentation and become dry. Instead of the pressing some must in active fermentation may be so added.

In all these different devices for controlling the fermentation it has been found that a fixed acidity of from 8 to 10 per 1,000 greatly assists in obtaining the result aimed at.

Copper pipes, tinned outside, may be immersed in the fermenting vat and a continuous stream of cold water allowed to flow in them as long as fermentation lasts. This method is practicable only where the supply of cold water is abundant, or where it is possible to cool down the water as it comes out of the refrigerating pipes.

Other refrigerators may be used like the one represented in the illustration, which I imported from France on behalf of Mr. James Angus of Minchinbury. This refrigerator worked all through the vintage last year with splendid results. The part of this apparatus figured 1 is the inlet of the hot must pumped from the vat into the cooler; 2, is the outlet of the must cooled down; 3, a pipe supplying cold water, which is received in the top basin and thence through a series of small holes, dropping over the pipes of the refrigerator; 4, the basin collecting the water; 5, the mouth of a ventilator, carrying at the top, not visible in the illustration, a Tangie blower. The strong wind coming from this air-pipe causes rapid evaporation of some of the water running over the cooler, thus lowering the temperature of said water.



Guilleband Must Refrigerator, as used by Mr. James Angus, Minchinbury Vineyard, Rooty Hill, N.S.W.

Hereunder I am pleased to insert a few notes referring to the working of this apparatus, which have been furnished at my request by Mr. Bühring, manager of Minchinbury vineyard.

## The Guilleband Wine Cooler in Practice.

Owing to the installation of the cooler not being complete at the beginning of vintage, the red musts fermenting vigorously soon rose in temperature exceeding 100° F., so that when the cooler was first used the initial temperature was 104° F., and this was reduced to 95° after 50 minutes of pumping, the total quantity of skins and musts being about 500 gallons.

This vat was a mixture of Lambrusquat and Hermitage with a density of 1,090 (Sallerons), and the temperature of the vat when filled was 83°. It fermented down to about 6 per cent. sugar and reached 104° F., was cooled to 95° F., rose again to 102° and was racked off through the cooler and the temperature reduced to 86° with 2 per cent. of sugar remaining. This subsequently fermented out, the temperature in the cask remaining at 86° till fermentation was complete. The wine is perfectly sound and dry.

With 120 gallons of water 280 gallons of wine were cooled from 102° to 85° in 50 minutes, the temperature of the water being 68° when running on to the cooler and 99° when running off the cooler. The blower was not used when these figures were noted, but it was found that when the blower was used the water ran off at 6–7° F. less than without it, showing what a greater cooling effect water has when impregnated with air. Other vats were treated similarly to the one described, and from the following the effects and usefulness of the cooler can be judged:—

Vat 7, Hermitage; density, 1,100; temp. of vat, 74°; max. temp., 94°, cooled to 77°, slow fermentation.

Vat 17, Hermitage; density, 1,095; temp. of vat, 74°; max. temp., 95°. This would not have been reached but owing to the failure of the pump the cooling could not be proceeded with till the next day, when the temperature was reduced to 79°. Fermentation complete, 4 days.

Vat 21, Hermitage; density, 1,090; initial temp. of vat, 80°; max., 91°; cooled to 76° with 10 per cent. sugar remaining; fermentation complete, 4 days, the temperature having gone to 83°.

Vat 24, White Shiraz; density, 1,087; temp. of must, 86°; put through cooler at once and cooled to 76°; max. temp., 85°.

Vat 27, White Shiraz; density, 1,090; temp. of must, 86°; put through cooler at once and cooled to 78°; max. temp., 90°, cooled again to 79°.

All of these, which are merely taken as average examples, fermented perfectly dry and are sound.

# Soil Deterioration and Erosion.

H. V. JACKSON.

In different soils the proportions of the most important mineral plant-foods (phosphoric acid, nitrogen, potash, lime, &c., &c.) vary; and these substances combine or separate chemically according to circumstances, and there is always some latent or unused portion left in the soil; moreover, they are not all present at all times in all soils. These stores of what is necessary to plant-life are taken up by the roots and fibres in a dissolved state, and subjected then to the plants' requirements by means of minute cells or bodies consisting of a jelly-like substance called protoplasm. Now, deeply-cultivated land absorbs the greater part of the water that falls upon it in the shape of rain, consequently, there is a naturally-stored quantity of water contained within a given cultivated area of much greater volume than there would have been if the surface had been of a smooth and unbroken character, or hard surface, allowing a considerable amount of water to flow away. The cultivation of the surface soil having, therefore, enabled the water to sink into the earth a considerable distance, there is naturally a smaller loss by evaporation than there would have been if the moisture were nearer the surface, susceptible to the drying winds and scorching sun rays. As a consequence, there is a greater food material for plants in deeply-cultivated ground, for not only is moisture admitted, but the soil is also more subject to the action of the atmosphere which, however dry, always contains some aqueous vapour, which is also absorbed by the soil and converted into water. Notwithstanding the depth to which water may have permeated the ground, moisture is always rising by capillary attraction, and under such movement is being deposited about the roots of plants. As the water rises, however, it does not come in the same form as when originally deposited, but is charged with all the materials encountered in its course in the shape of salts, &c., previously mentioned, and now rendered soluble through the action of water. As the water passes away near the surface in the form of vapour, these salts, &c., are not lost in such vapour but remain in the soil, therefore it is understood how water sinking into the soil becomes, through the influence of sunlight and air, the motive power in the transmission of food to plants. From these simple remarks it will be apparent how much depends upon the proper cultivation of land devoted to crops.

In hilly country, similar to that of the "Big Scrub" on the Richmond River, one of the losses the farmer has to contend with in some localities is the washing away or "erosion" of soil which takes place on the land he cultivates. In seasons in which the rain comes in frequent and light falls, or when heavy falls keep off until the sown crops have had time to furnish the soil with a supply of roots to hold it together, little harm may be done to the soil by cultivation; but if, as is often the case, heavy falls occur after the ploughing has been done and before the crops have made sufficient growth to protect the soil, the land becomes scarred with water channels and much valuable soil is washed away. In soils again like the black sandy loams which are common near the coast, and in their virgin state are at least fairly rich in decayed vegetable matter, excellent crops are at first grown. I have noticed, however, that after they have been for a few years under cultivation these soils undergo a marked change unless farm-yard manure has been applied to them frequently and regularly and green crops ploughed in occasionally. These soils, which at first were dark in colour and looked fertile, before long begin to become of a lighter colour; the humus to which their darkness was due appears to have vanished, and the originally rich looking soil has become of a light colour, and sometimes even almost white, and in appearance the very reverse of fertile. The richest of soils, when they are brought to this condition, become exceedingly sensitive of drought, and unless the season be distinctly moist, produce very poor crops. During my residence at Wollongbar I had a good deal of experience with the red loamy soil which is found there and in the neighbourhood. When it is first ploughed this soil has a beautiful appearance, and is neither too loose nor too heavy. After it has been under cultivation for a few years a diminution of its content of humus can be noticed, and in a dry time a want of something to bind together the particles of which it is composed is seen. The soil is then of a less inviting character and its consistency is like that of fine gunpowder; it cannot be called sandy, for its content of sand is not great, but its peculiarity is that it consists of fine particles with little tendency to cohere. When it is in this condition, if a heavy downpour of rain occurs, it absorbs the rain freely, but only to the depth to which it has been ploughed; below that, although there is no hard pan and the soil is similar to the original condition of that which is above, but is close—that is, the moisture does not penetrate quickly enough. This lower soil readily absorbs the moisture, but in heavy and continuous rains it is unable to take up the water sufficiently rapidly to relieve the super-soaked tilth above, and consequently this abundance of water begins to percolate along the surface of the pan scored by the plough, until, as it works down hill beneath the ploughed clods, it gathers such volume that it bursts upwards through the fine tilth in little water spouts, that gradually make runnels extending as the rain continues into small channels: these increase until the field on the hill side is scored and scarred and torn about in such manner that in places the depth of the ploughing is reached and exposed, the bright score of the plough being visible on the smooth surface of the bared subsoil from which the surface loam has been carried away, perhaps to overwhelm a crop on the flat below, or perhaps to the creek in the valley. There is serious loss of soil likely to result on some farms in course of years, where the contour is steep, unless attention is given to this. The darker chocolate soils generally, in my experience, were of a more stable character and not so prone to become exhausted rapidly.

During my four years' sojourn at Wollongbar it appeared to me to be a natural phenomenon in regard to rainfall in normal years, to have at any rate once in the twelve months a heavy downpour of rain, perhaps of short duration, but sufficient to wash the hills, cause the creeks to be swollen, and finally the river to rise. If you should happen at such a time to be travelling to the river by steamer, then as you beat about off the bar, waiting for the "stand off" signal to lower, you can see the line of coloured water as you steam from the blue of ocean to the soil-stained waters flowing outwards over the bar. Probably it has always been thus, but now that the beautiful green coating of vines, palms, lichens, and forest giants are being burnt and cleared in such manner as to practically denude the country for miles, the waters during storms have fuller sway; no green break prevails between sky and earth, and where the grass has not as yet had time to spring, or weeds to obtain a hold, the soil is exposed to be pelted and scored and washed away in quantities, which though not apparent to the eye, nevertheless over a given area and period of time must represent a considerable amount of loss. This loss from washing of the unbroken soil of the virgin land is nothing in comparison with the individual loss of the farmer who finds his cultivation area in course of time becoming less fertile and less satisfactory. Erosion in the cultivation area may be accelerated and made much worse through the system of ploughing. The repeated ploughing of land at an uniform depth over a series of seasons hardens and solidifies the crust of the subsoil at the bottom of the furrow; ploughing in such a manner should therefore be avoided. The land should, in the first instance, be subsoil ploughed, and properly and deeply worked, then in the future when the land is tilled for crop, let the early ploughing be deep, the late ploughing be shallow, and as evaporation in such a hot climate is intense, the surface tilling by harrowing, &c., should follow quickly, *i.e.*, immediately after the ploughing, unless showery weather prevails. In subsoiling it is unwise to bring the subsoil to the surface, especially in clay or close compact material as it will be more or less sour, *i.e.*, acid. In deep sandy loam subsoiling is not necessary—deep ploughing meeting all requirements.

Open furrows should be left at suitable distances, and proper drain furrows at the headlands.

Where the soil is in a fine tilth after growing a root crop, deep ploughing as a preparation for the crop to follow may be avoided. The disc harrow does excellent work, and the land should be cleaned of any small amount of rubbish there may be.

Stubble should be ploughed in, not burnt, everything being conserved that will help to make vegetable compost.

Two inches of rain will be readily absorbed and no ill effects take place in a paddock that has been ploughed at various depths up to, say, 8 or 9 inches. but where, as may happen in the Richmond district, 5 or 6 inches or more may fall at one time, it is only by precautionary measures the farmer will be able to check the waste of his cultivation soil. As the land is gradually cleared of forests, soil-waste will become the greater in hilly country, however imperceptible it may be, and the prevention or alleviation of such loss may be arrived at by the adoption of mechanical means, and taking advantage of what may be regarded as Nature's remedies.

By mechanical means, I refer to the system of cultivation, to the treatment of the soil with lime and manures, and to draining. By Nature's remedy, I refer to the reservation or provision of forest and coppice growth, and to quickly coating the land with green crops whether to plough in as a green manure or for crop.

With the present system of farming on the dairying areas of the higher and undulating lands, it is from nature's remedies the farmer will most readily obtain assistance. Manures and drain pipes are expensive, and therefore as a commencement when clearing a farm area it will be wise to endeavour to plan out a scheme beforehand of leaving belts or edges of forest growth along the ridges and on the side or sides of the farm likely to be most exposed to the most objectionable winds. No doubt, it is generally inadvisable to leave the larger growth of brush forest standing, because with the removal of their surroundings, they frequently decay with rapidity, and become a source of danger to fences and live stock; but by leaving the younger generation of shrubs and trees to grow up, when once they recover from the effects of any fire that may reach and run through the belt, they soon grow into a beautiful break-wind of indigenous trees, providing also a grateful shade for the animals of the farm.

In one instance, that came under my notice in regard to soil after continued cultivation, several unsatisfactory crops were produced on a plot that had been very constantly cultivated, notwithstanding a chemical analysis of the soil was of such a nature that you would expect something better. The weather certainly had not been so moist as usually experienced, and in the dry times the soil of this plot dried up and became of a most uninviting character in appearance of quality. I attributed this entirely to the exhaustion of the vegetable matter, the soil condition being such that the addition of chemical manure, in the absence of seasonable rains of sufficient volume, was not of much service. In the same locality, land entirely similar gave excellent results, where a system of ploughing in rape, or cow-pea, or other green crops had been followed. After observing trials of a like nature, I became satisfied that a careful system of ploughing and a systematic growing of green crops for ploughing in between the periods for which the land would be required for a farm crop, not only proved beneficial, but was calculated to save some expenditure for commercial fertilisers.

In orchards and such like cultivated areas frequent or constant cultivation to keep down weeds, &c., appeared to accelerate the exhaustion of vegetable matter in such soil, unless in conjunction with such work green crops of some description were frequently turned under.

It is, I think, too much the practice to adhere to one particular spot on the farm for a cultivation area,—this is no doubt due to the fact that on newly created farms there is perhaps only one position that has been stumped and made sufficiently clear of roots and rocks to permit of satisfactory ploughing; but as time passes and the other portions of the farm become fit for cultivation, it will prove most beneficial, and a considerable saving in every way to put old cultivation areas under grass, lucerne, or clover for a period; opening up new ground for cultivation, and by the time the farmer returns to the original cultivation area, he will find in ploughing-in the sod that a change in the soil has been effected through the deep rooting of the plants, and formation of a supply of vegetable matter, which will make the natural constituents of the soil to be available as plant-food; at the same time, the root fibres and vegetable matter will tend to hold the soil together, and enable it to take up moisture and conserve it for a longer period than is possible in land which has been exhausted of much of the humus it may at one time have possessed.

I observed in those instances where farmers were in the habit of leaving their land fallow after growing crops for one or two seasons, *i.e.*, allowing the paddock to be grassed for even a twelvemonth, that when they again came to put in crops of maize or oats or sorghum, the appearance of the crop generally was superior to the crops grown continuously season after season in one circumscribed area—and even where couch grass had a strong hold, and the cultivation might not always look so clean and tidy, yet owing to the amount of sod turned in, the soil constituents were so favourable that with all other things being equal, very satisfactory crops of maize were obtained, and little or no loss of soil in continuous wet weather.

There is yet another feature of the soil that should not be overlooked, and that is the presence of rocks and stones.

Geologists tell us that primitive or crystalline rocks form the basis from which other rocks and soils have been formed, the mineral matter contained in soil being derived from the decomposition of rocks. Heat expanding the rocks and cold contracting them, causes an amount of disintegration through the cracking and breaking up, which is further acted on by the rain and air. The wearing of rocks and stones into more or less fine particles, carries to the soil the elements they contain. Hence the stones found on many areas of land are not such an impediment to agriculture as might be thought, so long as the land is not altogether too stony. The stones exercise a beneficial influence, and in soils of the nature found at Wollongbar, they also help to hold the land. It is not, therefore, advisable to pick the small stones off land which under cultivation is disposed to become of an extremely friable or sandy character.

In one instance I to a great extent removed the stones from a small plot, and in course of time it was easily seen the plot was not giving anything like the satisfaction a neighbouring plot did that was thickly strewn with small stones, and as a consequence I came to the conclusion that where rather large stones were met with it would be more profitable to break them up than to have them actually removed. The best crops of maize I grew were on one of the stoniest places on the farm.

Porous stones absorb a certain amount of moisture, and in that respect conserve the moisture and tend to allay evaporation.

The matters mentioned in this paper are simple and, perhaps to some minds superfluous—they may, however, be of use to some, and set others thinking. Frequently people do not sufficiently appreciate and utilise the opportunities they have of adding valuable materials to the soil of their cultivation paddock, a trial, however, will soon satisfy the sceptic of the benefits of a fallow period, and of the advantage of cultivating the soil immediately after crop and ploughing under some green stuff. It is necessary in these days to have our eyes open to the works of the Creator around us, to exercise the habit of observation, and learn our lesson from the open book of Nature as we go, noting the seasons, the insect and bird life, the vegetation of field and forest, and the soil, all of which affect our prosperity when any changes of a serious character arise, whether brought about through the actions of men or arise from natural causes.

## SPECIAL PRIZE FOR BEST COLLECTION OF N.S.W. COMMERCIAL TIMBERS.

THE Hon. the Minister for Agriculture has approved of the donation of a Special Prize of £25 for the best collection of native commercial timbers of New South Wales, to be exhibited at the Annual Show of the Clarence Pastoral and Agricultural Society to be held at Grafton on the 6th and 7th May next.

The conditions under which the award will be made are:—The timber in the exhibit to be seasoned, of good quality, free from sap and heartwood, rends, and insect holes, with the exception of the sections of girders which will have the heartwood, and the piles which will contain heart and sapwood. The timbers are to be cut square at each end, and to have local names attached to each sample. The exhibit to embrace—

| Timbers suitable for— | How cut. | Size of Samples. | No. of samples of each timber. |
|---|---|---|---|
| Railway sleepers ... ... | Squared by axe | 3 ft. x 10 in. x 5 in. | One. |
| Railway or bridge girders ... | „ ... | 3 ft. x 12 in. x 12 in. | One. |
| Railway waggons ... ... | Sawn ... ... | 3 ft. x 3 in. x 4 in. | Two. |
| Bridge decking ... ... | „ ... ... | 3 ft. x 10 in. x 2 in. | One. |
| Paving blocks ... ... ... | „ ... ... | 9 in. x 4 in. x 1 in. | Three. |
| Flooring boards ... ... | „ ... ... | 3 ft. x 4 in. x 1 in. | Three. |
| Furniture use ... ... ... | „ ... ... | 3 ft. x 12 in. x 2 in. | Two. |
| Felloes ... ... ... ... | „ ... ... | 2ft. 6in. x 5in. x 4½ in. | Three. |
| Spokes ... ... ... ... | Split and finished | 2 ft. 9in. x 5 in. x 2½ in. | One in the rough; one finished. |
| Shafts of drays, buggies, &c... | Sawn ... ... | 10 ft.... ... ... | Two. |
| Piles ... ... ... ... | In the round ... | 3 ft. x 12 in. x 2 in. | One. |
| Carriage building ... ... | Sawn ... ... | 3 ft. x 12 in. x 2 in. | Two. |
| Turnery ... ... ... | „ ... ... | 3 ft. x 3 in. x 3 in. | Two. |
| Collection of miscellaneous timbers. | ............ | 12 in. x 6 in. x 1 in. | |
| Butter boxes (optional) ... | ..... ...... | ..... ............ | One. |

The collection of timbers receiving the prize to become the property of the Government, with the object of sending same to the Commercial Agent in London, where they will be exhibited.

# Seed Wheat.

(Continued from page 50.)

By N. A. COBB.

## I—continued.

### *Relative Fodder Value of Large and Small Grains of Wheat.*

The relative fodder-value of large and small grains of wheat has been a subject of attention on my part for some years. The amount of decisive evidence one way or the other has, however, been unsatisfactory. From such evidence as was known to me, and from reasoning based on this evidence and by reasoning from analogy, I had come to regard small grains as, weight for weight, of somewhat less feeding value than large grains. The following notes on the subject are of a more definite character than anything I have hitherto been able to formulate from my own observations. They serve to render it probable that the difference is not a large one.

If these conclusions are correct, it is well to keep in mind that they justify to some extent the breeding of wheat-varieties for prolificness regardless of the size of their grains.

Similarly it is well to consider in cleaning and grading wheat for seed that what is removed in the shape of small but otherwise sound grain has a feeding-value about equal to that of large plump grain.

It is well known that some of the most prolific varieties of wheat have spikelets carrying four to five grains, of which the upper ones are quite small. If these small grains had, weight for weight, a smaller food-value than the others, it would become a question how far it is advisable to encourage the prolificness of the plant along these lines. If, on the contrary, the fodder-value of these smaller grains is greater than that of the large grains, or equal to it, then there need be little fear in encouraging the production of such small grains.

As a concrete illustration of the principle under discussion, we may take a wheat of the Defiance type. The illustration on page 37† is of such a wheat. The grains are shown as having been removed from one side of the ear, and they are arranged in the order in which they were taken from the various spikelets. It will be seen how much smaller are the upper grains of the more prolific spikelets than the lower ones.

In order to ascertain the relative value of the two sorts of grain, comparisons were instituted between the large and small grains of the same ears and of the same spikelets. It did not seem worth while to compare the small grains of one ear or plant with the large ones of another ear or plant.

Hence, in order to secure material for a just comparison, a large grain and a small grain were taken from each of seven different spikelets. This gave charges of unequal weight, the seven small grains weighing much less than the seven large grains. The disparity was made up by taking three more small grains from the same spikelets. It was not considered best to collect from other spikelets. In a word, the comparison was made between the large and small grains of the same spikelets derived from near the middle of a single ear. This method seemed to throw out, as far as possible, any factors that would nullify the value of such a comparison.

The selected grains were in all cases plump, and of the best quality of their respective sizes, as the accompanying photographs will witness. The illustrations show the two samples examined, the photographs being taken natural-size just before weighing. (See Figs. 23 and 24 on the next page.)

Relative value of the large and small grains of a Defiance Wheat.

| | Large grains. | Small grains. |
|---|---|---|
| *Bran and embryo (dry) ... ... ... | 12·7 per cent. | 12·0 per cent. |
| Bran, dry ... ... ... ... ... | 10·4 ,, | 9·8 ,, |
| Embryo (by differemce) ... ... ... | 2·3 ,, | 2·2 ,, |

These figures represent weights after a rigid microscopic cleansing from all traces of starch and gluten and other possible contents of the flour cells. This leaves the starch, gluten, water, and water-solubles at 88 per cent. for the small grains, and 87·3 per cent. for the large grains, a slight difference in favour of the small grains, providing the amount of water is proportional in the two cases, and also providing the relative proportions of starch and gluten are the same, and are equally digestible and nutritious.

---

* The term bran is here used to include all layers down to and including the aleuron layer.

† January *Gazette*.

These qualifications are too numerous to be altogether satisfactory. It may, however, be said with some certainty that the amount of flour present in the two cases is, for equal weight of grain, very nearly the same. If there were no milling difficulty in extracting the flour, the weights derived by theoretically perfect milling ought to be about the same.

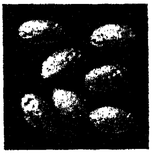


**Fig. 23.**—Natural size photograph of seven large plump Defiance wheat-grains, used in the biological analysis described in the text. These were compared in "fodder value" with the ten small grains removed from the same spikelets, and shown in Fig. 24.

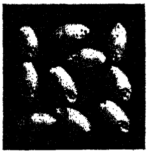


**Fig. 24.**—Natural-size photograph of the ten small plump Defiance wheat-grains, used in the biological analysis described in the text. These were compared in "fodder value" with the seven large grains removed from the same spikelets, and shown in Fig. 23.

It seemed to me probable that the areas of the bran would present differences in the two cases, and accordingly the areas were measured, with the following results :—

| | |
|---|---|
| Area of the bran of seven large grains used in the foregoing examination, and weighing ·261 gram. ... ... ... | 465·1 sq. mm. |
| Area of the bran of ten small grains, used in the foregoing examination, and weighing ·205 gram. ... ... ... | 415·6 sq. mm. |

The figures 180·5 and 228· represent, approximately at least, the relative flour content of the two samples.

If the bran areas on large and small grains are proportional to the flour content, then we ought to have—

$$180{\cdot}5 : 228 = 415{\cdot}6 : 465{\cdot}1,$$

but this proportion is not true, the last term requiring to be 523·6 to preserve the equality,—an increase of 12·6 per cent.

From this it will be seen that the area of the bran is *greater in proportion on the small grains.* As a small amount of flour is left attached to the bran after milling, it may be surmised that the additional area of bran in the case of small grains is a disadvantage, as carrying away with it to be sold as bran an additional amount of flour, all the more as the bran of the small grains, being a little thinner, will, other things being equal, be less perfectly freed of its flour.

An experiment on similar lines was carried out with a Purple Straw Wheat. Eight small grains, weighing ·318 gram., were compared with seven large grains, weighing ·447 gram.

RELATIVE value of large and small grains of a Purple Straw Wheat.

| | Large grains. | Small grains. |
|---|---|---|
| Bran and embryo (dry) ... ... ... | 13·2 per cent. | 12·3 per cent. |
| Gluten (dry) ... ... ... ... ... | 8·28 ,, | 7·9 ,, |
| Starch (dry) ... ... ... ... ... | Lost. | 67·6 ,, |

In a general way this evidence is corroborative of that derived from the Defiance wheat. The two samples were obtained in the same way, except that the number of grains in the latter two charges is more equal in number. Not much value is attached to the determinations of starch in this case.

As in the Defiance wheat, so again here, it was found on measuring the areas of the grains that the large grains have less area of bran in proportion to the amount of their contents than do the small grains. To keep the proportion the bran area of the large grains would have to be increased 10·9 per cent. As before the bran of the smaller grains was the thinner.

It is perhaps needless to again call attention to the fact that the grains used for this examination were derived from single ears of wheat, and that therefore the comparison has been made between the large and small grains produced by *one and the same plant.* Whether the result of comparing the large grains and the small grains taken at random would give the same result is another matter, though it seems to me probable that large grains from one plant, when compared with small grains from another of the same variety, grown under similar conditions, would give results corresponding with those presented above.

As the bulk of our wheat is of varieties that produce large and small grains in the same ear, it would seem that the results here given may be applied with safety in discussing questions relating to our wheat crops and their conversion into food products.

Some evidence exists that the flour actually produced from large plump grains is of a better quality than that from small plump grains derived from the same plants, for one thing, the gluten content of the flour from the large grains being higher.

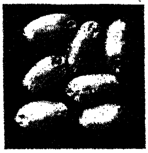


Fig. 25.—Natural size photograph of seven large plump grains of a Purple Straw wheat, used in the comparative examination described in the text. These were compared in "fodder value" with the eight small grains removed from the same spikelets, and shown in Fig. 26.

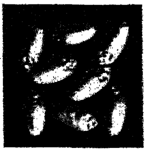


Fig. 26.—Natural size photograph of eight small plump grains of a Purple Straw wheat, used in the comparative examination described in the text. These were compared in "fodder value" with the seven large grains removed from the same spikelets, and shown in Fig. 25.

We may supplement these observations on the relative fodder value of large plump grains and small plump grains by saying that shrivelled wheat has a fodder value as chick-feed about equal to that of plump wheat, the fodder value of the shrivelled wheat being reported as the better in some instances. If now we add to this scientific evidence of the good fodder value of shrivelled grains and of small plump grains the well-known fact that the market price of "chick-wheat" is often only a little lower than that of good milling wheat, we see how little ground there is for using wheat tailings as seed on the score of so-called "economy."

## II.—Large and Plump versus Small and Shrivelled Seed.

### *The Row System.*

THE tendency of agriculture is such that it must lead to the wider and wider adoption of the row system of experiment The keynote of agricultural progress is the lessening of the cost of production by a wider and wider use of machines. These machines work in straight lines, at least theoretically, from which it follows that the drill-coulter and its product, *i.e.* a row of plants, comes to represent the unit of agriculture. Each crop is simply so many rows of plants. The row represents the crop reduced to its lowest terms. All the properties of the crop exist in the single row, broadly speaking, and, of course, with exceptions. The exceptions are, however, so few as to exert no great influence on the general statement.

Most experiments are an inquiry into the properties of a small but representative crop, and owing to the costliness of the work the size is reduced as much as is compatible with the end sought. This leads always to a search for the element of which the ordinary crop is simply a multiple. What is this element? We answer—"To-day for the best agriculture it is the single row; and what is true to-day of the best agriculture will in the course of time be true of all agriculture. The wider and wider adoption of machinery appears to make this inevitable."

Though one may not easily find this idea expressed in so many words there is plenty of evidence, in recent agricultural experiment work, of a more extended use of the row system. In the United States it is coming into general use. I speak from personal observation at nearly half the experiment stations in the United States. One needs, however, only to look over the representative views given in the account of these stations as published for the recent Paris Exposition, to see how generally it is adopted. Certain trials that have been going on for many years are being continued on the plot system because they were so begun, but otherwise than this there is a strong tendency, and in my opinion a most laudable tendency, to reduce field experiments as nearly as possible to single rows, and to confine the comparisons to those that can be made between adjacent rows or adjacent long and narrow plots, and to eschew other comparisons. This tendency and that towards the wider introduction of pot experiment work are, I should think, among the most striking tendencies of recent agricultural experiment work.

These remarks are in explanation of the methods adopted in the trials here reported, with reference to the relative value as seed of large, small, and medium-sized wheat grains.

It will be noted that in the tables the reader is directed to make comparisons only between certain rows, these being in all cases rows that were adjacent, and distant from each other two links or about sixteen inches. It may be asked, why not compare other cases? What is the objection to making comparisons between rows two spaces, *i.e.*, four links apart? To these questions I should reply that it is in my opinion unsafe to make such comparisons, because the conditions of growth are so variable. As a single instance

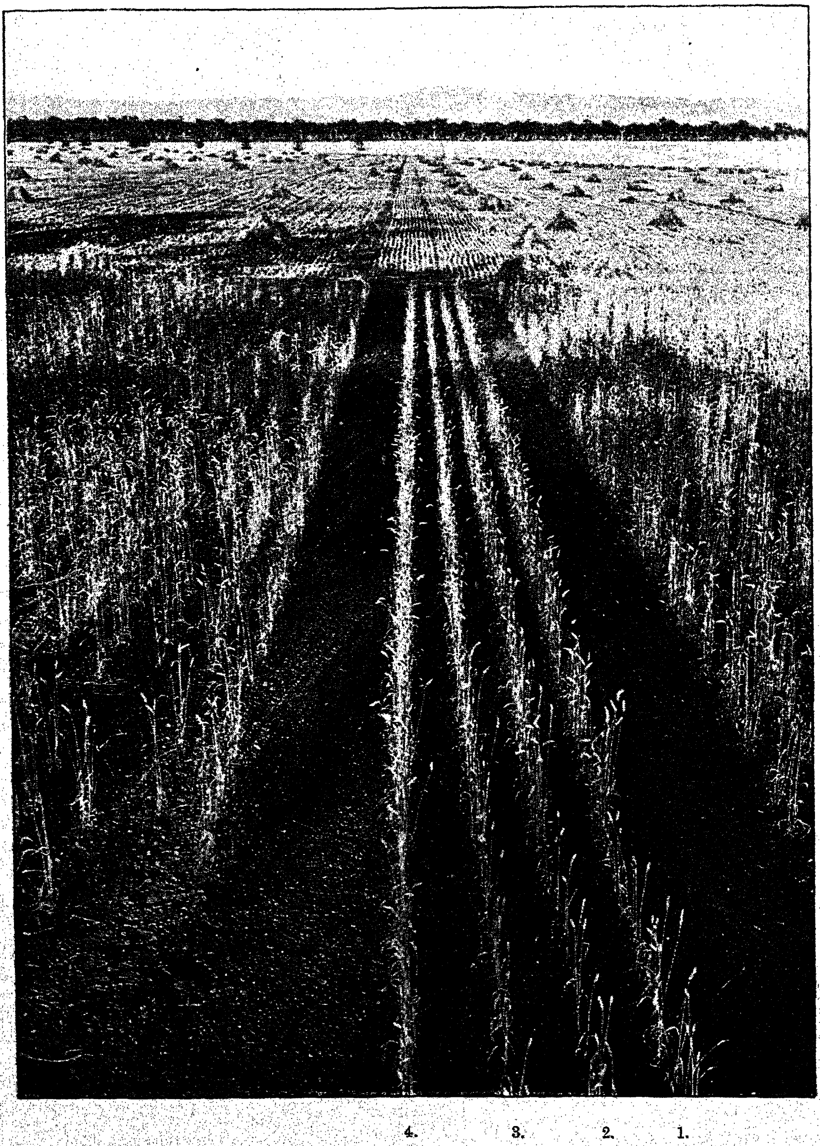


**Fig. 27.**—To show method of testing the qualities of large, medium-sized, and small grains of wheat. Row 1 is from large seed, 2 is from medium-sized seed, 3 is from tailings, while 4 is from extra large and plump seed. The differences in growth are due solely to the varying size of the seed, so far as it was found possible to control the field conditions; and it was found possible to control them to a large extent, as described in the text. The trial here shown is Rattling Jack, 1896.

of this variability of conditions one may cite the difference in the supply of natural water due to various causes. The rain may not fall evenly. Eminent meteorologists assure us that rainfall is very capricious. The rainfall at places only a few feet apart may be quite appreciably different, and under certain conditions of dryness this variation in the fall probably exerts a considerable influence in causing variations in plant growth. Apart from this, it needs no great experience to cause one to question, even when the rain falls evenly, whether it becomes evenly distributed in the soil. Suppose the case of a short shower, in which the precipitation is sharp for a few minutes; such showers as are not at all uncommon. How is it possible to know that the unavoidable variations in the surface of the soil and variations in the underground condition of the soil do not cause an uneven distribution of this water to the plants of a crop? Let anyone watch the surface distribution of water during a short shower, as the author has often taken the trouble to do, on ordinary cultivated ground, and he will soon see, if the rainfall becomes sharp, how unevenly the small surface currents distribute the water that afterwards soaks more or less completely into the ground. Thought and observation of this kind have led me to be rather cautious about making comparisons among plants and crops grown under field conditions.

It seems to me that the history of crop experiment work shows a multitude of instances where caution of this kind has remained profoundly unthought of, or else has been thrown to the winds, and I cannot help thinking that much of the admittedly unsatisfactory nature of field experiment work reported is due to this lack of thoughtful caution, combined with a readiness to report the results of a single year's experiments in terms that do not point clearly to the low value that often attaches to an isolated field experiment.

The late Sir John Laws once said to the author, in a conversation on the underlying principles of agricultural experiment work, that he early formed the habit of thinking long over an agricultural theory or experiment before expressing an opinion. One sees in that remark a grain of the wisdom that has made Rothamstead so great a landmark in the history of agriculture. No doubt it was this "long thought" that led to the absence of rash expressions of opinion connected with Rothamstead work.

Most of us might take a leaf from Sir John's book in this respect. To think long and to say little, to repeat experiments again and again so as to be able to compare and verify over and over, and yet say little; to make endless excursions among the logical pitfalls that are the special danger of the interpreter of field experiments, and yet to say little; or, as Sir John Laws put it, "to think long" before expressing a definite opinion on an agricultural experiment or theory,—this must certainly be the best possible course to adopt.

Reasoning thus I have been led to abstain from calling attention to any comparisons other than those it is possible to make between the adjacent rows of the seed-wheat experiments now to be described.

### *Seed Wheat: Large Plump versus Small Shrivelled Seed.*

The first of the systematic trials to ascertain the relative seed value of large plump grains and small and shrivelled grains were undertaken in 1894. The results of these trials are given in the following table:—

FIRST TRIAL—LARGE PLUMP VERSUS SMALL SHRIVELLED SEED.

| No. | Sown. | (Approximate) Grade. | Length of Row. | No. of Plants that grew. | Lb. Harvested. | | Grain. | Straw. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Grain. | Straw. | Bu. to Acre. | Cwt. to Acre. | |
| | | | | | *Zealand.* | | | | |
| 1 | May 4 .. | 300 | 1·21 ch. | 91 | 2·41 | .... | 16·60 | .... | Comp. No. 2. |
| 2 | ,, .. | 200 | ,, | 106 | 2·09 | .... | 14·40 | .... | Comp. No. 1. |
| | | | | | *Zealand.* | | | | |
| 3 | May 4 .. | Plump .... | 1·21 ch. | .... | 2·22 | .... | 15·30 | .... | Comp. No. 4. |
| 4 | ,, .. | Shrivelled . | ,, | .... | 2·13 | .... | 14·68 | .... | Comp. No. 3. |
| | | | | | *Hudson's Early Purple Straw.* | | | | |
| 5 | May 6 .. | 300 | 1·26 ch. | 111 | 4·72 | .... | 31·22 | .... | Comp. No. 6. |
| 6 | ,, .. | do. Shriv. | ,, | 107 | 3·72 | .... | 24·60 | .... | Comp. No. 5. |
| | | | | | *Rattling Jack.* | | | | |
| 7 | May 10 .. | 300 | 0·95 | 65 | 2·44 | .... | 21·40 | .... | Comp. No. 8. |
| 8 | ,, .. | Shrivelled | 0·75 | 75 | 2·81 | .... | 24·65 | .... | Comp. No. 7. |
| | | | | | *White Velvet.* | | | | |
| 9 | May 19 .. | 300 | 1·10 ch. | 97 | 1·69 | .... | 12·80 | .... | Comp. No. 10. |
| 10 | ,, .. | Shrivelled . | ,, | 80 | 1·34 | .... | 10·15 | .... | Comp. No. 9. |

This set of experiments is interesting chiefly as the initial set of the whole series, and as the one that gave direction to all the following sets. The difficulty of securing anything like exactness in the grading of the samples planted gave rise to the adoption of the sieves with accurately constructed millimetre meshes,* and to the methods of grading described below. The present samples of seed were hand-picked, and the grade numbers inserted in the table are only approximate, as they were derived afterwards by comparison with graded samples. The land was newly cleared, and very patchy, and in this respect not in very good condition for wheat, or for experiment purposes. The season was one of the best ever experienced on the Wagga Farm. The spring rains at the time of sowing were abundant, and throughout the season the conditions were favourable to the growth of wheat. The crops of the district were unusually good. It was the year of the flood of the Murrumbidgee River.

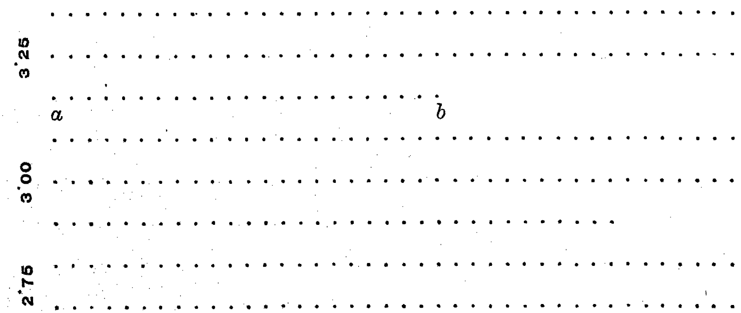


Fig. 28.—Diagram to represent the method of planting the rows. The first three rows, 2 links apart with plants 1 link apart in the rows, are of the 3·25 grade. The third row is incomplete because of insufficient seed, and hence only the portion *a* to *b* could be compared with the corresponding portion of the first row of the 3·00 grade plants. Most of the fractional rows reported in the tables arose in this manner.

The object of the experiments was to try good plump grains alongside rust-shrivelled ones, the latter, of course, being at the same time smaller than the former. In the four cases where the smaller seeds are marked shrivelled, they were so from the effects of rust, having been selected for the purpose of these trials from rusty plants the previous season.

Summing up, we may say that the plump seed gave the best return of grain in four cases out of five, and that the average excess was 18·52 per cent. taking the lower yield as the basis of computation, while in the single case in which the shrivelled seed exceeded the yield of the plump, the excess was 15·19 per cent. The straw was not weighed: had it been weighed it probably would have been shown, as in subsequent years, that the total marketable product was greatest from the large and plump seeds in practically all cases. This opinion was formed when it was too late to examine the straw, and this was what led to weighing the straw in subsequent years.

The number of trials was too small to be completely satisfactory.

*How the various sizes of seed were prepared for the second and subsequent trials.*

The method adopted to obtain seed for the comparative tests gave seven grades, each grade being composed of seeds very much alike in size, and, consequently, also in weight. These are the seven grades so frequently mentioned in the first part of this report, and illustrated in Figs. 4 to 10. The seeds might have been selected by weight instead of by size, or they might have been selected by a process taking account of both size and weight. The method adopted—that of sieving—is, however, nearly the same as that by means of which seed-wheat should be prepared on the large scale, and this fact was what decided the method of selection.

The following three points are worthy of note in connection with the process of selection by means of the sieves here used. They have a definite bearing on the subject, and should be studied carefully by the reader who wishes to understand the details of the investigation.

(1.) As the various transverse diameters of wheat grains are unequal, the grains will stop, or not stop, on a mesh of a certain size, according as they happen to present one or the other diameter towards the mesh. This would lead to unequal grading if a sample of grain were simply passed once through the sieve. In order to get gradings that are as nearly as possible comparative, it is, therefore, necessary to continue passing the sample through the sieve until all the grains will invariably pass through. These repeated sievings give each grain a chance to present its largest transverse diameter to the mesh, and so ultimately to remain in the sieve and be saved in that grade if possible. This repeated sieving will, however, introduce a very serious error if the meshes of the sieves be not quite accurate. If, for instance, there is one mesh in a sieve that is a little larger than the others one might keep on sieving until all the grains had had a chance to pass through this particular mesh, in which case it is evident that the whole sample would become wrongly graded. The repeated sieving is very tedious, and to really reach a stage at which no grain will fail to pass, requires a very long time. It has, therefore, been the writer's practice to have the samples passed through each grade sieve a certain number of times according to the exactness required. Thus, in a certain instance where moderate accuracy would suffice, the samples would be passed five times through. In other instances they would be passed ten times through, and so on. Of course, in a given experiment all samples would be treated alike. As to the size of the meshes and their accuracy, in the absence of any standard an arbitrary one based on metric measures was adopted, as explained elsewhere; and to ensure accuracy the author himself made and adjusted the meshes of the sieves employed, and periodically inspected them in order to ensure regularity in the gradings. See pages 34* and 35, and Figs. 2 and 3.

---

* These sieves are shown and explained in Figs. 2 and 3.

(2.) A shrivelled grain is always smaller than it would have been if it had grown properly, so that in the process of grading here employed such grains fall into lower grades than they would have fallen into had they grown properly. From this it happens that in all the comparisons here presented we have to a greater or less extent, yet often to a small and insignificant extent, trials between plump and shrivelled grains, that is provided there were any shrivelled grains in the samples being tested, as was usually, in fact almost invariably, the case. Of course this refers to grains shrivelled from whatever cause. In certain cases specially noted the cause of the shrivelled condition was known, and the observations were directed specially towards the behaviour of such cases. It is believed that in most cases the shrivelled condition of the grains was due to a variety of causes, including all of the common causes of shrivelling.

(3.) All varieties of wheat, and especially some of them, present grains that in comparison with their fellows are flat, and such grains pass on in the method of grading here employed to lower grades than their real weight and size would entitle them to occupy. On the other hand the same varieties also present roundish grains that stop in higher grades than they should by strict right occupy. I think these two opposite qualities may just about neutralise each other in all the grades except the highest and lowest; in these, however, it seems probable than an appreciable difference in yield is caused, namely, the yield of the highest will be relatively lowered and the yield of the lowest will be relatively raised. These remarks apply to normal seeds. Where the seeds are much shrivelled they often pass on to the tailings, and there present themselves as grains, apparently much larger than the average of the tailings on account of their tendency to present to the eye their largest rather than their narrowest contour. Such grains, of course, were laid out for large-sized ones, but for some reason they have failed to fill out, though they may sometimes contain a good-sized embryo. I have no doubt that this fact will explain to some extent the results of the comparisons between the tailings and the 200 grade, in which comparisons there appears a smaller superiority of the 200 than would be naturally expected, considering the results of the other comparisons.

### *Shrivelled Grain.*

It is impossible to give a perfectly accurate definition of the term "shrivelled seed." It is, nevertheless, necessary in a discussion of this subject, to make it clear what degree of imperfect growth is meant by the term as used in various connections.

What is meant by saying that shrivelled seed is poor seed or the reverse? Probably the cause of the whole discussion on the value of shrivelled wheat-seed has been the fact that extremely inferior-looking seed will actually germinate and, to a certain extent, grow and bear a crop. To one who does not understand the physiology of plant growth, this phenomenon may seem wonderful, but to the initiated it is in no degree remarkable. The fact that seed "as light as chaff" has been sown and has produced a crop of grain has, nevertheless, given rise to considerable surprise, a good deal of discussion, and, unfortunately, much wrong practice.

From this it follows that the term "shrivelled seed," as sometimes used in this connection, means seeds that are much shrivelled, so shrivelled as to be easily blown away by the wind. I do not, however, confine the term in this manner. By shrivelled seed, I mean seed that is in any marked degree shrivelled; and in order to give the discussion more definiteness, drawings of seeds variously shrivelled are inserted (see p. 33*), and these are referred to in the text in such a manner as to render mistake unlikely.

---

* January *Gazette*.

### SECOND TRIAL.

The second set of trials in connection with the relative seed value of large, medium sized, and small grains of wheat was undertaken in 1895. The tabulated results of these trials are given below. (See page 153.)

It will be seen that the experiments include 117 trial rows containing twenty-three varieties of wheat, representative of all the types that are largely grown in the State. The trials cover about seventy different comparisons between equal numbers of seeds of varying grades or sizes, the comparison being between the yields of grain and straw from larger grains on the one side and smaller grains on the other.

The season was an average season, and the land was typical Riverina wheat land with perhaps a tendency to vary more than usual towards freshly-decomposed granite. The rows were placed side by side, and occupied, with the other rows among which they were distributed, a space 2 chains wide and 3 chains long. The land sloped gently toward the west, and improved in quality from top to bottom. The "small-seed" rows were in all cases on the down-hill side, so that whatever difference in fertility there was from the gradual change for the better at the lower end of the plot was in favour of the small seeds. This small balance in favour of the small seeds would be trifling in amount, as the rows compared were never more than 2 links apart, and I have, therefore, disregarded it. There is no way of satisfactorily estimating its amount, and it is, accordingly, necessary to content oneself with the general statement of its existence and the insignificance of its amount.

It must be borne in mind, however, that the various pairs of rows were, as a rule, not adjacent to each other, so that the reader must guard against the impression that in the case of any variety he is reading the records of a *succession* of rows. In the table the various rows are numbered in succession for convenience of reference; but the actual growth was in a different order. There is no chance of error in reading if the reader simply notes what comparisons are to be made, and, as before pointed out, this is only permissible in the case of two rows growing next each other. Sometimes the middle row of three is compared with each of the two adjacent rows.

The rows were cared for by hand during the entire season. There was no cultivation beyond that necessary to keep down the weeds; but this was an amount that must be taken into consideration in interpreting the results. The weeds were pulled by hand, or were cut out with a hand hoe. There was no desire to cultivate, but simply a desire to give the trial rows, as nearly as possible, identical conditions. If the weeds would have grown uniformly, they would have been allowed to grow. As they would not grow uniformly, but would grow more in one place than another, and thus rob one row more than another, it was thought best to keep them down with as little disturbance to the soil as possible.

This removal of the weeds is, it seems to me, decidedly in favour of the smallest seeds, as the trials show that nearly if not quite all adverse conditions are more severe on the smallest seeds. Hence relieving the smallest seeds from the competition of weeds was a greater favour to them than to the largest seeds. I do not consider that this matter was of much importance in comparisons of adjacent rows from seed above the 250 grade or thereabouts, but I think that the tailings and the 200 grade benefited considerably by this treatment as compared with the larger grades.

If there be objection to assuming that the method adopted would really favour the smaller seed, there can hardly be any objection to assuming that at least there was no favour shown the large seed, unless, indeed, it be assumed that culture favours large seed more than it does small seed, an assumption so far removed from probability that I think it may be safely disregarded.

If the method followed was neutral so far as relative yield is concerned, then in calculating how much a farmer can afford to spend in improving his seed we have a simple proportion. If, for instance, the yields here given are twice those the farmer is accustomed to get, then the extra yield here shown to be due to the use of large plump seed has only to be divided by two to give the figures upon which the farmer may proceed.

An examination of the tables will at once show that under the conditions of the trials there was inferior germination and growth of the smallest seeds, or perhaps it would be better to confine the statement to that part which relates to growth. The table pretends to show nothing as to the precise amount of germination that took place, the statistics being confined to the number of plants that actually grew and presented themselves at harvest-time in a condition in which it was possible to cut and weigh them. It may be as well to state, however, that the plants missing at harvest-time were almost wholly instances of failure to properly germinate, at any rate in the cases of the smallest grains. If these lost plants appeared above ground, they were weak seedlings that could not compete with ordinary conditions, and so succumbed. The care exercised was such that it was very rare indeed for a plant to be injured by the method adopted to keep down the weeds. Where a plant disappeared it may be taken for granted that it was from "natural" causes.

*How the yields were compared.*

In the following tables, generally speaking, the comparisons are made between the yield of plants grown from seed of one grade and the yield from seed of the grade next below; but this is not always the case. In some instances the yield from the largest seed (Fig. 4) is compared with the yield from the smallest seed (Fig. 10), but such instances are exceptional. Grade 200 was necessarily always compared with the tailings; so also 225 could be compared only with the grade immediately below or with that two steps below. As we progress to higher and higher grades there is an ever-increasing chance that the comparison may be between widely-different grades; but, as before remarked, the aim in this statement of trials was to compare, as far as convenient, each grade with that one or two steps below it, and this result was, in general, secured, as will be seen on examining the tables in detail. A rather different and simpler system was adopted in the third and subsequent trials.

Perhaps, the best general statement of the results may be made by saying that the 325 grade proved itself better in capacity to grow and to yield both grain and straw than the 300 grade; that in a similar manner the 300 grade proved itself superior to the 275 grade, which in turn proved superior to 250 grade, and so on to the bottom of the list. We have to make an exception in the case of the 225 grade, where, in fact, the number of trials is too small to be decisive.

However, even this statement of the superiority of each grade over those immediately below it, and by implication and in fact, over *all* below it, is not a statement that needs no explanation or qualification, for it will be observed that the relative superiority of the 200 grade while it is decisive for the season in question is not so great as that of other grades. This is due to two facts—first, the comparison was always with the grade immediately below, while in the other grades, in some instances, the comparisons were extended to grades two and three steps below; second, the tailings with which the 200 was always compared is a miscellaneous lot of seed that passes the two-millimetre mesh, but may, nevertheless, contain some really rather large seed, owing to the fact that some seeds in every lot are so flat that they pass on to the grades lower than their real size would warrant. Now, while this fact operates throughout the system of seeding obtained by the process of grading adopted, I am inclined to think that it operates most strongly in the case of the tailings where there is no further attempt to grade, and where, therefore, these extra flat seeds collect that should pass on to lower grades, if such existed.

TABLE of Yields of Grain and Straw. (Second Trial.)

| No. | Sown. | Grade. | Length of Row, in Links. | No. of Plants that grew. | Lb. Harvested. | | Grain. | Straw. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Grain. | Straw. | Bu. to Acre. | Cwt. to Acre. | |
| *Algerian.* | | | | | | | | | |
| 1 | May .. | 325 | 192 | 182 | 4·09 | 7·13 | 17 72 | 18·54 | Comp. No. 2. |
| 2 | ,, .. | 275 | 192 | 164 | 3·52 | 6·50 | 15·25 | 16·90 | ,, Nos. 1 and 3. |
| 3 | ,, .. | 250 | 192 | 149 | 4·47 | 7·00 | 19·37 | 18·20 | ,, No. 2. |
| *Allora Spring.* | | | | | | | | | |
| 4 | 6 May .. | 250 | 192·5 | 172 | 6·46 | 7·00 | 27·99 | 18·20 | Comp. No. 5. |
| 5 | 5 June .. | 200 | 192·5 | 162 | 6·11 | 6·63 | 26·48 | 17·24 | ,, Nos. 4 and 6. |
| 6 | 5 ,, .. | Tls. | 192·5 | 141 | 6·06 | 5·00 | 26·26 | 13·00 | ,, No. 5. |
| *Allora Spring 2nd.* | | | | | | | | | |
| 7 | 5 June .. | 250 | 192·5 | 179 | 6·10 | 6·06 | 26·43 | 15·76 | Comp. No. 8. |
| 8 | 5 ,, .. | Tls. | 192·5 | 157 | 5·44 | 3·81 | 23·57 | 9·91 | ,, No. 7. |
| *Australian Talavera.* | | | | | | | | | |
| 9 | May .. | 300 | 192 | 169 | 6·06 | 7·88 | 26·26 | 20·49 | Comp. No. 11. |
| 10 | ,, .. | 250 | 192 | 169 | 7·74 | 9 00 | 33·54 | 23·40 | ,, No. 11. |
| 11 | ,, .. | 275 | 192 | 161 | 6·19 | 7·56 | 26·82 | 19·66 | ,, Nos. 9 and 10. |
| *Bearded Quartzlee.* | | | | | | | | | |
| 12 | 5 June .. | 275 | 192·5 | 179 | 6·02 | 4·88 | 26·09 | 12·69 | Comp. No. 13. |
| 13 | 5 ,, .. | 250 | 192·5 | 177 | 6·07 | 5·75 | 26·30 | 14·95 | ,, No. 12. |
| 14 | 5 ,, .. | 250 | 99 | 95 | 3·60 | 3·19 | 30·31 | 16·11 | ,, No. 15. |
| 15 | 5 ,, .. | Tls. | 99 | 90 | 3·59 | 2·75 | 30·23 | 13·89 | ,, No. 14. |
| 16 | 4 ,, .. | 275 | 192·5 | 178 | 6·00 | 5·50 | 26·00 | 14·30 | ,, No. 17. |
| 17 | 4 ,, .. | 250 | 192·5 | 174 | 5·95 | 5·38 | 25·78 | 13·99 | ,, No. 16. |
| 18 | 4 ,, .. | 250 | 192·5 | 180 | 6·78 | 6·06 | 29·38 | 15·76 | ,, No. 19. |
| 19 | 4 ,, .. | Tls. | 192·5 | 166 | 5 90 | 5·00 | 24·58 | 13·00 | ,, No. 18. |

TABLE of Yields of Grain and Straw. (Second Trial)—*continued.*

| No. | Sown. | Grade. | Length of Row, in Links. | No. of Plants that grew. | Lb. Harvested. | | Grain. | Straw. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Grain. | Straw. | Bu. to Acre. | Cwt. to Acce. | |
| | | | | *Blount's Lambrigg, Hay.* | | | | | |
| 20 | 1 June .. | 200 | 192 | .... | .... | 5·19* | .... | 13·49 | Hay, comp. No. 21. |
| 21 | 1 ,, .. | 275 | 192 | .... | .... | 7·88 | .... | 20·49 | ,, ,, Nos. 20 & 22. |
| 22 | 1 ,, .. | 200 | 192 | .... | .... | 7·63* | .... | 19·84 | ,, ,, No. 21. |
| | | | | *Canning Downs.* | | | | | |
| 23 | 6 June .. | 325 | 102 | 94 | 4·66 | 2·25 | 38·07 | 11·03 | Comp. No. 24. |
| 24 | 6 ,, .. | 300 | 102 | 91 | 3·57 | 1·63 | 29·17 | 7·99 | ,, No. 23. |
| 25 | 6 ,, .. | 275 | 192·5 | 175 | 6·50 | 3·38 | 28·17 | 8·79 | ,, No. 26. |
| 26 | 6 ,, .. | Tls. | 192·5 | 159 | 6·38 | 2·56 | 27·65 | 6·66 | ,, No. 25. |
| 27 | 6 ,, .. | 300 | 192·5 | 119 | 6·15 | 3·31 | 26·65 | 8·61 | ,, No. 28. |
| 28 | 6 ,, .. | 275 | 192·5 | 174 | 6·69 | 3·63 | 28·99 | 9·44 | ,, No. 27. |
| 29 | 6 ,, .. | 250 | 192·5 | 175 | 7·56 | 4·00 | 32·76 | 10·40 | ,, No. 30. |
| 30 | 6 ,, .. | Tls. | 192·5 | 149 | 7·60 | 3·31 | 32·93 | 9·44 | ,, No. 29. |
| 31 | 6 ,, .. | 300 | 192·5 | 163 | 7·99 | 4·19 | 34·62 | 10·89 | ,, No. 32. |
| | 6 ,, .. | 275 | 192·5 | 169 | 7 23 | 4·94 | 31·33 | 12·85 | ,, No. 31. |
| | | | | *Early Baart.* | | | | | |
| 33 | May .. | 325 | 75 | 64 | 3·76 | 3·25 | 41·74 | 21·65 | Comp. No. 34. |
| 34 | ,, .. | 300 | 75 | 68 | 2·94 | 2·50 | 32·63 | 16·65 | ,, No. 33. |
| 35 | ,, .. | 300 | 192·5 | 169 | 6·96 | 6·56 | 30·16 | 17·06 | ,, No. 36. |
| 36 | ,, .. | 275 | 192·5 | 164 | 6·74 | 6·38 | 29·21 | 16·59 | ,, Nos. 35 and 37. |
| 37 | ,, .. | 225 | 192·5 | 175 | 6·69 | 6·31 | 28·99 | 16·41 | ,, Nos. 36 and 38. |
| 38 | ,, .. | 200 | 192·5 | 165 | 7·72 | 6·38 | 33·45 | 16·59 | ,, No. 37. |
| | | | | *Early Para.* | | | | | |
| 39 | May .. | 275 | 192 | 166 | 6·61 | 6·06 | 28·64 | 15·76 | Comp. No. 40. |
| 40 | ,, .. | 200 | 192 | 156 | 5·32 | 5·00 | 23·05 | 13·00 | ,, No. 39. |
| 41 | ,, .. | 200 | 192 | 152 | 6·24 | 5·69 | 27·04 | 14·79 | ,, No. 42. |
| 42 | ,, .. | Tls. | 192 | 137 | 4·85 | 4·25 | 21·02 | 11·15 | ,, No. 41. |
| | | | | *Golden Drop.* | | | | | |
| 43 | 5 June .. | 300 | 102 | .... | 2·83 | 3·00 | 23·12 | 14·70 | Comp. No. 44. |
| 44 | 5 ,, .. | 275 | 102 | 85 | 2·90 | 3·06 | 23·69 | 14·99 | ,, No. 43. |
| 45 | 5 ,, .. | 275 | 192·5 | 177 | 6·77 | 6·63 | 29·34 | 17·24 | ,, No. 46. |
| 46 | 5 ,, .. | Tls. | 192·5 | 148 | 5·92 | 5·63 | 25·65 | 14·64 | ,, No. 45. |
| | | | | *Gross's Prolific.* | | | | | |
| 47 | May .. | 300 | 192 | 177 | 6·11 | 6·88 | 26·48 | 17.89 | Comp. No. 48. |
| 48 | ,, .. | 275 | 192 | 176 | 6·18 | 6·69 | 26·78 | 17·39 | ,, No. 47. |
| 49 | ,, .. | 275 | 192 | 179 | 6·29 | 6·25 | 27·26 | 16·25 | ,, No. 50. |
| 50 | ,, .. | 250 | 192 | 182 | 6·08 | 6·13 | 26·35 | 15·94 | ,, No. 49. |
| 51 | ,, .. | 250 | 192 | 175 | 5·87 | 6·25 | 25·44 | 16·25 | ,, No. 52. |
| 52 | ,, .. | 200 | 192 | 176 | 5·37 | 5·63 | 23·27 | 14·64 | ,, No 51. |
| 53 | ,, .. | 200 | 192 | 168 | 5·62 | 5·44 | 24·35 | 14·14 | ,, No. 54. |
| 54 | ,, .. | Tls. | 192 | 174 | 6·56 | 5·63 | 28·43 | 14·64 | ,, No. 53. |
| | | | | *Hudson's Early Purple Straw.* | | | | | |
| 55 | May . | 300 | 123 | 117 | 5·62 | 5·69 | 38·10 | 23·13 | Comp. No. 56. |
| 56 | ,, .. | 200 | 123 | 104 | 4·36 | 4·88 | 29 56 | 19·84 | ,, No. 55. |
| 57 | ,, .. | 200 | 123 | 98 | 4·80 | 4·38 | 32·54 | 17·80 | ,, No. 58. |
| 58 | ,, .. | Tls. | 123 | 85 | 4·87 | 5·25 | 33·02 | 21·34 | ,, No. 57. |
| | | | | *King's Jubilee.* | | | | | |
| 59 | 6 June .. | 325 | 63 | 51 | 2·60 | 1·69 | 34.40 | 13·42 | Comp. No. 60. |
| 60 | 6 ,, .. | 300 | 63 | 61 | 2·14 | 1·56 | 28·31 | 12·39 | ,, No. 59. |
| 61 | 6 ,, .. | 300 | 192·5 | 170 | 6·57 | 4·63 | 28·47 | 12·04 | ,, No. 62. |
| 62 | 6 ,, .. | 275 | 192·5 | 154 | 6·18 | 5·31 | 26·78 | 13·81 | ,, No. 61. |
| 63 | 6 ,, .. | 275 | 177 | 170 | 6·97 | 4·44 | 32·83 | 12·54 | ,, No. 64. |
| 64 | 6 ,, .. | 250 | 177 | 157 | 6·29 | 4·75 | 29·63 | 13·42 | ,, No. 63. |
| 65 | 6 ,, .. | 250 | 107 | 91 | 4·15 | 3·25 | 32·33 | 15·19 | ,, No 66. |
| 66 | 6 ,, .. | Tls. | 107 | 82 | 3·96 | 2·63 | 30·85 | 12·29 | ,, No. 65. |
| | | | | *Marshall's No. 3.* | | | | | |
| 67 | 3 June .. | 200 | 192·5 | 171 | 5·66 | 4·81 | 24·53 | 12·51 | Comp. Nos. 68 and 69. |
| 68 | 3 ,, .. | Tls. | 192·5 | 156 | 5·28 | 3·41 | 22 88 | 8·87 | ,, No. 67. |
| 69 | 3 ,, .. | 300 | 192·5 | 178 | 6·52 | 5·56 | 28·25 | 14·46 | ,, No 67. |
| 70 | 3 ,, .. | 300 | 192·5 | 186 | 6·55 | 5·56 | 28·38 | 14·46 | ,, No. 71. |
| 71 | 3 ,, .. | 200 | 192·5 | 175 | 5·85 | 4·38 | 25·35 | 11·39 | ,, Nos. 70 and 72. |
| 72 | 3 ,, .. | Tls. | 192·5 | 177 | 6·19 | 4·69 | 26·82 | 12·19 | ,, No. 71. |
| | | | | *Marshall's No. 8.* | | | | | |
| 73 | May .. | 300 | 192 | 180 | 6·28 | 7·75 | 27·21 | 20·15 | Comp. No. 74. |
| 74 | ,, .. | 275 | 192 | 176 | 5·78 | 7·63 | 25·05 | 19·84 | ,, Nos. 73 and 75. |
| 75 | ,, .. | 225 | 192 | 175 | 5·68 | 7·19 | 24·61 | 18·69 | ,, Nos. 74 and 76. |
| 76 | ,, .. | 200 | 192 | 171 | 6·08 | 7·69 | 26·35 | 19·99 | ,, Nos. 75 and 77. |
| 77 | ,, .. | Tls. | 79 | 61 | 2·85 | 3·31 | 24·79 | 20·96 | ,, No. 76. |

TABLE of Yields of Grain and Straw. (Second Trial)—*continued.*

| No. | Sown. | Grade. | Length of Row, in Links. | No. of Plants that grew. | Lb. Harvested. |  | Grain. | Straw. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | Grain. | Straw. | Bu. to Acre. | Cwt. to Acre. |  |
|  |  |  |  | *Red Straw.* |  |  |  |  |  |
| 78 | 4 June .. | 275 | 192·5 | 176 | 6·85 | 5·31 | 29·68 | 13·81 | Comp. No. 79. |
| 79 | 4 ,, .. | 200 | 192·5 | 166 | 6·65 | 5·50 | 28·82 | 14·30 | ,, Nos. 78 and 80. |
| 80 | 4 ,, .. | Tls. | 192·5 | 157 | 7·04 | 5·06 | 30·51 | 13·16 | ,, No. 79. |
|  |  |  |  | *Talavera de Bellevue.* |  |  |  |  |  |
| 81 | 1 June .. | 300 | 97 | 92 | 2·41 | 2·38 | 20·70 | 12·27 | Comp. No. 82. |
| 82 | 1 ,, .. | 275 | 97 | 93 | 2·53 | 2·75 | 22·75 | 14·18 | ,, No. 81. |
| 83 | 1 ,, .. | 275 | 75 | 70 | 2·22 | 2·69 | 24·64 | 17·94 | ,, No. 84. |
| 84 | 1 ,, .. | 200 | 75 | 69 | 1·83 | 2·06 | 20·31 | 13·73 | ,, Nos. 83 and 85. |
| 85 | 1 ,, .. | Tls. | 75 | 61 | 1·88 | 1·69 | 20·87 | 11·27 | ,, No. 84. |
|  |  |  |  | *Velvet Pearl.* |  |  |  |  |  |
| 86 | May .. | 300 | 192·5 | 170 | 7·11 | 4·88 | 30·81 | 12·69 | Comp. No. 87. |
| 87 | ,, | Pigmy | 192·5 | 129 | 55·6 | 3·50 | 25·09 | 9·10 | ,, No. 86. |
| 88 | ,, .. | 250 | 192·5 | 173 | 5·92 | 4·44 | 25·65 | 11·54 | ,, No. 89. |
| 89 | ,, .. | 200 | 192·5 | 156 | 5·79 | 4·13 | 25·09 | 10·74 | ,, Nos. 88 and 90. |
| 90 | ,, .. | Tls. | 192·5 | 122 | 5·37 | 3·56 | 23·27 | 9·26 | ,, No. 89. |
|  |  |  |  | *White Lammas.* |  |  |  |  |  |
| 91 | 3 June .. | 325 | 192·5 | 187 | 6·14 | 9·06 | 26·61 | 23·55 | Comp. No. 92. |
| 92 | 3 ,, .. | 300 | 192·5 | 179 | 5·44 | 8·31 | 23·57 | 21·61 | ,, No. 91. |
| 93 | 3 ,, .. | 300 | 110 | 101 | 3·13 | 4·38 | 23·71 | 19·91 | ,, No. 94. |
| 94 | 3 ,, .. | 275 | 110 | 102 | 2·79 | 3·81 | 21·14 | 17·32 | ,, No. 93. |
| 95 | 3 ,, .. | 275 | 127 | 118 | 3·59 | 4·75 | 23·55 | 18·70 | ,, No. 96. |
| 96 | 3 ,, .. | 225 | 127 | 121 | 4·25 | 5·44 | 27·88 | 21·42 | ,, No. 95. |
| 97 | 3 ,, .. | 300 | 158 | 139 | 5·23 | 6·44 | 27·56 | 20·38 | ,, No. 98. |
| 98 | 3 ,, .. | 200 | 158 | 146 | 4·34 | 5·31 | 22·87 | 16·81 | ,, Nos. 97 and 99. |
| 99 | 3 ,, .. | Tls. | 158 | 137 | 5·34 | 5·63 | 28·14 | 17·82 | ,, No. 98. |
|  |  |  |  | *White Naples.* |  |  |  |  |  |
| 100 | May .. | 275 | 97 | 90 | 2·51 | 2·88 | 21·56 | 14·85 | Comp. No. 101. |
| 101 | ,, .. | 225 | 97 | 86 | 2·54 | 2·75 | 21·82 | 14·18 | ,, No. 100. |
|  |  |  |  | *White Tuscan.* |  |  |  |  |  |
| 102 | 3 June .. | 275 | 145 | 141 | 4·67 | 5·31 | 26·84 | 18·31 | Comp. No. 103. |
| 103 | 3 ,, .. | 200 | 145 | 137 | 4·31 | 4·75 | 24·77 | 16·38 | ,, Nos. 102 & 104. |
| 104 | 3 ,, .. | Tls. | 145 | 131 | 5·51 | 4·69 | 31·67 | 16·17 | ,, No. 103. |
|  |  |  |  | *White Velvet.* |  |  |  |  |  |
| 105 | May .. | 300 | 192 | 168 | 8·75 | 6·63 | 37·92 | 17·24 | Comp. No. 106. |
| 106 | ,, .. | 275 | 192 | 176 | 8·25 | 5·75 | 35·75 | 14·95 | ,, No. 105. |
| 107 | ,, .. | 275 | 192 | 176 | 7·44 | 5·63 | 32·24 | 14·64 | ,, No. 108. |
| 108 | ,, .. | 200 | 192 | 181 | 6·26 | 4·63 | 27·13 | 12·04 | ,, No. 107. |
| 109 | ,, .. | 200 | 192 | 177 | 6·60 | 4·75 | 28·60 | 12·35 | ,, No. 110. |
| 110 | ,, .. | Tls. | 192 | 159 | 6·35 | 4·06 | 27·52 | 10·56 | ,, No. 109. |
|  |  |  |  | *Zealand.* |  |  |  |  |  |
| 111 | May .. | 325 | 192 | 167 | 7·75 | 10·00 | 33·58 | 26·00 | Comp. No. 112. |
| 112 | ,, .. | 300 | 192 | 164 | 6·10 | 8·00 | 26·43 | 20·80 | ,, No. 111. |
| 113 | ,, .. | 275 | 182 | 171 | 6·29 | 7·06 | 28·81 | 19·49 | ,, No. 114. |
| 114 | ,, .. | 200 | 182 | 137 | 4·37 | 5·75 | 20·01 | 15·81 | ,, Nos. 113 & 115. |
| 115 | ,, .. | Tls. | 182 | 138 | 5·27 | 6·50 | 24·13 | 17·86 | ,, No. 114. |
|  |  |  |  | *Marshall's No. 8.* |  |  |  |  |  |
| 116 | May .. | 200 | 192 | 175 | 5·13 | 7·50 | 22·23 | 19·50 | Comp. No. 117. |
| 117 | ,, .. | Tls. | 192 | 175 | 5·10 | 6·88 | 22·10 | 17·89 | ,, No. 116. |

## SUMMARY OF GROWTH. (Second Trial.)

The rate of germination and growth is shown by the fact that—

Out of 816 grains of the 325 grade 91·3 per cent. grew.
,, 3,032 ,, 300 ,, 90·4 ,,
,, 4,376 ,, 275 ,, 90·5 ,,
,, 2,495 ,, 250 ,, 90·1 ,,
,, 608 ,, 225 ,, 91·6 ,,
,, 3,494 ,, 200 ,, 87·1 ,,
,, 3,848 ,, Tailings 80·3 ,,

By this is meant that this percentage of the grains produced plants that could be cut and weighed, though the plants did not in all cases mature seed. The harvesting was done with a sickel, the plants being cut close to the ground and as evenly as possible. If the plant had died when a seedling, and before it had produced a stalk, it would not enter into the calculation. Mere dead blades of young seedlings were not counted, and no attempt was made to weigh such. There were very few such cases. The counting was done at harvest time. Uncertain cases were of very rare occurrence. If a plant survived the first few weeks it nearly always reached a growth that was harvested, and if there was no grain on the plant the straw was cut and weighed just the same.

Few notes were taken on the germination, for the reason that they would have been of rather uncertain value. If no plant appeared at the place where a seed had been sown, that would be no proof that the seed had not germinated, though it would be evidence *tending* to show that it had not germinated. The plantlet might have been killed by disease or by some insect. A considerable number of examinations convinced me that most of the cases of this sort were really cases of failure to germinate; but it will be at once seen that any attempt to settle definitely in such a case whether the seed failed to germinate or was killed off by disease would have involved considerable difficulty.

Nevertheless, some attention was given to this feature of the experiment, with the result of showing that so far as observation in the spring could be reasonably carried, it apparently showed a lower germination on the part of the smaller seeds—certainly a lower plant-producing power. I am inclined to believe that these observations (see the table on page 157) prove the *germinating* power of the small and shrivelled seeds to be less than that of others; but I hesitate somewhat in the matter, because of results already published by others tending to show that the germinating power of rust-shrivelled seed is actually greater than that of plump seed. As before remarked, these counts of the plants as they appeared above ground are not thoroughly reliable evidence as

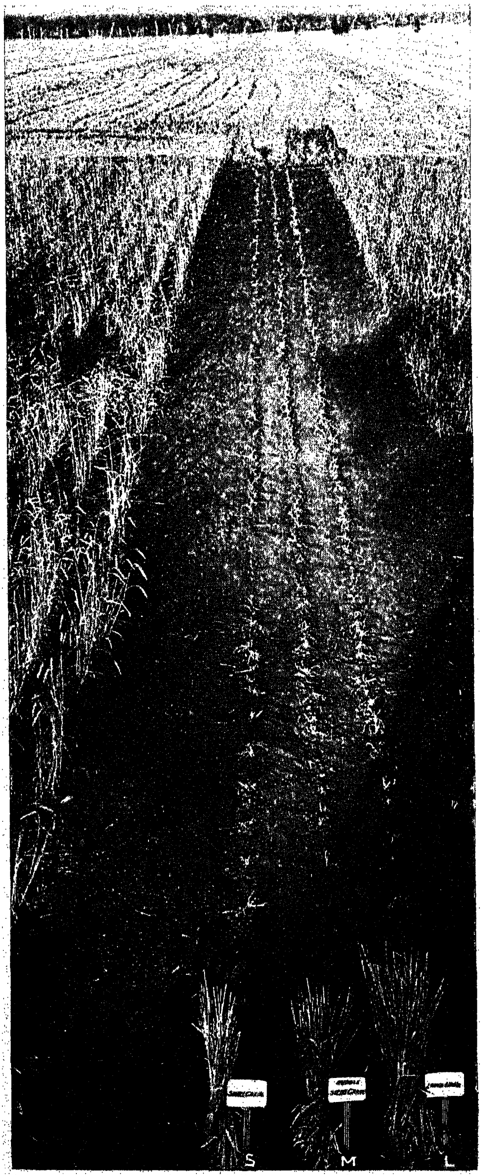


**Fig. 29.**—Photograph of three rows of experiment wheat after harvest. The rows from large, medium-sized, and small grain are lettered respectively L, M, and S. The picture shows the relative amounts of straw from the various rows, and the greater proportion of "misses" of the smaller seed.

to the germinating power of the seed, and for several reasons. In the first place, one cannot be certain that plants may not yet appear after the count is made; some good seeds even are very slow in germinating. Then, again, the plantlet may have been good—and yet have failed to reach the surface because it was nipped by some underground insect.

It should be borne in mind that the number of plants that appeared above ground in these experiments was probably greater than would occur in ordinary field practice because of the extra care bestowed upon the planting and culture, this care being necessary in order to remove as far as possible all disturbing factors that might cause inequalities in the conditions under which the various seeds were grown. It is also right to again call attention to the fact, or at least what seems to me to be the fact, that these conditions were such as to favour the small seeds more than the large seeds. All this is a separate matter from the inferiorities of ordinary tailings due to the accumulation in them of diseased seed. All the grains used in these trials were derived from selected healthy plants. This is more fully explained elsewhere. With these few remarks, we may now examine the following table of apparent germination:—

APPARENT Germination of Large, Medium-sized, and Small Grains, as shown by the appearance above ground of Plants three weeks after Sowing, 1896. The figures represent the number of failures in 200 seeds planted.

| Variety. | Large. | Medium. | Small. | Variety. | Large. | Medium. | Small. |
|---|---|---|---|---|---|---|---|
| Algerian .. .. .. | 18 | 25 | 45 | Steinwedel .. .. | 6 | 7 | 23 |
| Marshall's No. 3 .. | 16 | 17 | 35 | Australian Talavera .. | 3 | 2 | 10 |
| Golden Drop .. .. | 8 | 19 | 51 | Quartzlee (Beardless).. | 8 | 3 | 13 |
| Canning Downs .. | 7 | 19 | 44 | Early Para. .. .. | 7 | 6 | 9 |
| White Tuscan .. .. | 14 | 13 | 38 | Farmer's Friend .. | 23 | 37 | 54 |
| King's Jubilee .. .. | 10 | 17 | 30 | White Velvet . .. | 0 | 42 | 65 |
| Blount's Lambrigg .. | 21 | 25 | 55 | Hudson's E.P. Straw | 13 | 20 | 28 |
| Allora Spring .. .. | 21 | 22 | 44 | Tardent's Blue .. | 20 | 33 | 41 |
| White Lammas.. .. | 7 | 11 | 17 | Red Straw .. .. | 15 | 21 | 28 |
| Early Baart .. .. | 10 | 13 | 46 | Marshall's No. 3 .. | 11 | 17 | 21 |
| White Lammas (Young) | 3 | 7 | 22 | Grosse's Prolific .. | 7 | 12 | 30 |
| Velvet Pearl .. .. | 11 | 22 | 44 | Marshall's No. 3 .. | 14 | 17 | 18 |
| White Naples .. .. | 62 | 60 | 71 | | | | |
| Bearded Quartzlee .. | 11 | 15 | 45 | Total .. .. | 363 | 540 | 988 |
| Talavera de Bellevue .. | 13 | 22 | 30 | | | | |
| Budd's Early .. .. | 3 | 9 | 24 | | | | |
| | 4 | 7 | 7 | Average .. .. | 12·5 | 18·6 | 34·1 |

These figures may be easily converted to percentages of failure by dividing by two. It will be noted that nearly three times as many small grains failed as large ones, and that the actual failure of the small grains amounted in this case to about one-sixth.

A considerable number of weaklings appeared, especially among the plants from small and shrivelled seeds, and these, after languishing for a few weeks, died. The soil was rather patchy, and in a considerable number of instances plants were rendered sterile by diseases due to unfavourable soil conditions. There was almost no loss through loose smut and bunt.

So far as comparisons of yield were concerned, the soil losses just spoken of were largely rendered nugatory by the row system. The other losses, such as accidents, smut, and bunt, fell irregularly, and were allowed for, if possible, but these losses were of too trifling an amount to cause any anxiety as to the reliability and usefulness of the calculations. The plots were in careful hands all the time, and I never saw experiments carried out under any better field conditions, if the patchiness be excepted. The experiment seed was prepared by myself, and its sowing was under my personal supervision, and all the notes were made by myself from frequent observation. The harvesting and so forth was done under my personal supervision, and I attended personally to all the weighings and calculations. The plots were under the competent supervision of the late Mr. John Coleman, who took great pains to preserve the plots from the least interference, and when I was absent kept me informed as to progress of the growth. The grains were sown in rows two links apart, and the grains were in all cases sown one link apart in the rows in the manner described in my pamphlet on "Agricultural Experiment Work." There were buffer plants at the ends of the rows in this lot of trials as in all others.

### SUMMARY of Comparisons. (Second Trial.)

If we take as the yield of each trial the sum of the weights of the grain and of the straw, we find that in all cases the various grades have excelled in their production the smaller grades with which they have been compared, if we except grade 225, and even this exceptional result seems due beyond doubt to the small number of trials—only two, both cases giving a substantial excess to the lower grade. If we class the trials according to the size of the larger of the grades used in the comparison, we may make the following general statement:—

325 excelled in 100 per cent. of trials.
300 ,, 78·6 ,, ,,
275 ,, 75 ,, ,,
250 ,, 100 ,, ,,
225 ,, none ,, ,,
200 ,, 53·8 ,, ,,

This statement, however, does not tell the whole story, for we find that, as in most unequal contests, the victories of the better contestant are the more decisive. Thus—

325 when excelling did so by 21·1 per cent. excess, and was never excelled.
300 when excelling did so by 12·5 per cent. excess; when excelled it was only by 5 per cent.
275 when excelling did so by 14·7 ,, ,, ,, ,, only 12·3 per cent.
250 ,, ,, 13·8
225 ,, ,, ,, ,, ,, 7·7 ,,
200 ,, ,, 14·5 ,, ,, ,, ,, ,, 11·6 ,,

*From this I conclude that the yield of wheat-plants under the conditions of these particular experiments, as well as the power to grow to a harvestable size, is a function of the size of the seed, and varies directly with the size of the seed.*

If, instead of taking the sum of the weights of the grain and straw as the criterion of yield, we take the grain alone, we arrive at the following:—

The 325 grade excelled in 100 per cent. of the trials.
,, 300 ,, ,, 69 ,, ,,
,, 275 ,, ,, 72·2 ,, ,,
,, 250 ,, ,, 87·5 ,, ,,
,, 225 ,, ,, none ,, ,,
,, 200 ,, ,, 42·9 ,, ,,

As these general statements, however, fail to give a perfectly correct idea of the extent of the superiority of the large seeds, we may add—

325 when excelling did so by 22·7 per cent., and was never excelled.
300 ,, ,, 13·8 ,, when excelled it was only by 3·9 per cent.
275 ,, ,, 11·8 ,, ,, ,, ,, 12·5 ,,
250 ,, ,, 7·0 ,, ,, ,, ,, ,, ·5 ,,
225 ,, ,, ,, 11·2 ,,
200 8·2 ,, ,, ,, 13·0 ,,

If, instead of taking the sum of the weights of the grain and straw as the criterion of yield, we take the straw alone, we arrive at the following:—

The 325 grade excelled in 100 per cent. of the trials.
,, 300 ,, ,, 69 ,, ,,
,, 275 ,, ,, 75 ,, ,,
,, 250 ,, ,, 100·0 ,, ,,
,, 225 ,, ,, none ,, ,,
,, 200 ,, ,, 71·4 ,, ,,

As these general statements do not give a perfectly correct idea of the extent of the superiority of the large seeds, we may add that—

325 when excelling did so by 20·0 per cent.
300 ,, ,, 14·6 ,, when excelled it was only by 10·0 per cent.
275 ,, ,, 16·2 ,, ,, ,, 11·6 ,,
250 ,, ,, 20·6 ,,
225 ,, ,, ,, 4·0 ,,
200 ,, ,, 20·2 ,, ,, ,, 9·9 ,,

I have referred to the losses due to little understood and inexplicable soil conditions, and have said that they were rendered nugatory by the row system. By this, I mean that when a patch of such varying soil appeared, it invaded in about equal degrees the various experiment rows, and thus caused about equal losses to the adjacent rows being compared. In a few instances, where it was apparent that this invasion was not of an equal character, the length of the rows was reduced at harvest time by cutting out the doubtful parts. There were but few cases where this discretion had to be exercised; it was exercised as sparingly as possible. The case had to be one of the most manifest injustice to one or the other of the contestants before I ordered any interference. It will be seen from the measurements of the rows (the normal length was about 192·5 links), this discretion was not often exercised. It should be added that in most of the cases where the row harvested is less than 192·5 links long, it is because there was insufficient seed of one of the contestants to fill a whole row. This will be better understood by reference to the diagram illustrative of the arrangement of the experiments. (Fig. 28, p. 150.) The fragments of rows were due to the fact that the supply of seed did not fill exactly a number of full rows, and the seed was too valuable to be wasted, its production having cost a considerable amount of expert labour.

It will be seen that the results given in the tabulated weighings of grain and straw relate solely to the plants that grew, this being probably the test that most nearly meets the requirements of practice. I have recorded the number of plants that grew in each case, but have concluded, for the present at any rate, to make no attempt to interpret the figures.

The conditions of the trials were field conditions, modified to meet the requirements of exact experiment. That the yields exceed those of actual agricultural practice of the region where they were conducted is due to careful planting in measured drills and to the attention already described as having been given to the prevention of weeds.

Returning now to the percentages of growth, it will be seen that from the 325 grade down there is a regular diminution in the power of the seed to produce plants under field conditions. The number of plants is so great, running as it does into thousands, and the number of varieties is so great, reaching as it does above twenty widely different sorts, and the dates of sowing are so various and the soil conditions are so varied, including as they do patchiness and a general variation from one end of the area to the other in the manner described elsewhere, that this variation in the power to produce plants appears to be proved to be a function of the size of the seed. So far as one season's work can go, I do not see how it is possible to reach any other conclusion than that the inherent power in a grain of wheat to produce a yield of grain or straw is some direct function of the size of the grain, and that the larger the grain the better the resulting plant will be, independent of any conditions that appeared during the particular season under discussion. The number of trials of the 325 and 225 grades is rather too few to be quite satisfactory; and I am inclined to think that a larger number of trials of these grades might have slightly modified the percentages of growth of these grades as given.

At this point, I would like to once more call attention to the fact that the conditions of the experiment were such as make me believe that the small, and therefore weak seeds, and the shrivelled and therefore weak seeds, were decidedly favoured. The careful planting and the keeping down of the weeds would, it seems to me, give relatively greater benefit to the weaklings than to the others. It is, therefore, reasonable to suppose that under ordinary field conditions,—as, for instance, when the grain is broadcast and the weeds are given full swing,—the percentages of growth would be lower still for the smaller grades than here recorded, lower in reality and lower in proportion.

I must remark, for the benefit of those who have never had an opportunity to observe the behaviour of wheat plants growing in drills, that the interpretation of the numbers given in the tables needs to make allowance for a certain extra growth due to lack of competition when a plant fails anywhere in the drill. In such case, the two plants next the vacant space are given more soil room and are freed from the efforts of a competitor on one side, and they consequently often grow a little better. This is an observation easily made, and the fact is well known no doubt to many, but it might be overlooked by others if no mention was made of it. This factor may have helped the rows with the greater number of "misses" more than it helped the other rows. It certainly would do so in some instances.

Thus, when it is said that one grade yielded 178 plants and the adjacent grade yielded nly 163 plants, it must not be assumed that the yields would tend to become as 178 to 163, for this is so only to a certain extent, owing to the fact that the plants in the maller lot profited considerably more by the death of their companions in the same row.

Doubtless, also, this same influence extended from one row to another, but it was only to a very limited extent. It was, in fact, so small and so uncertain a factor that I had to abandon all attempts to settle its value. It was most certainly very small—too small to exert an influence that would be more than barely appreciable. It is, in fact, quite remarkable how little influence even powerful factors exert beyond the distance of a few inches in most seasons in the soil used for these experiments. For instance, a heavily-manured row will fail to have more than a very faint effect on a check row two links away and without manure.

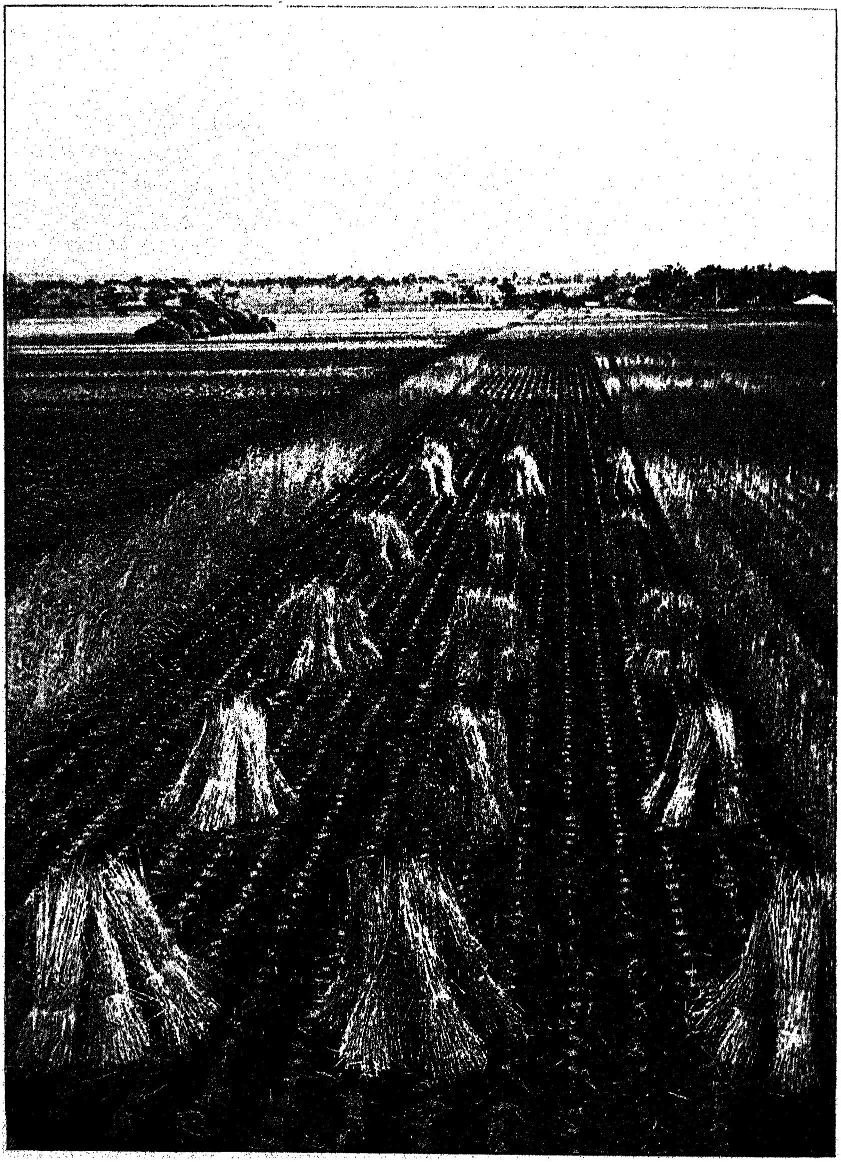


**Fig. 30.**—All the straw from the large, medium, and small sized seed experiments of 1896-7, arranged, not on the ground on which it was grown, which was impossible, but assembled on another experiment area where it could be effectively displayed. The left-hand row of stooks came from the large seeds, and weighs 180 lb., the middle row from medium-sized seeds, and weighs 151 lb., while the right-hand row came from small seeds, and weighs 118 lb. This is an assemblage of straw from more than twenty different varieties.

## THIRD TRIAL.

The third and most satisfactory and symmetrical set of trials as to the relative value as seed of large, medium-sized, and small grains of wheat was begun in 1896. The tabulated results are given below.

The conditions under which this set of trials was conducted were in most respects very similar to those of the sets already discussed. The soil, though poorer, was of the same general nature, *i.e.*, was patchy, and varied also in a gradual manner from part to part of the plot. In this case, however, there was no uniformity in the gradual changes such as were mentioned in the second case. It will be remembered that in the former cases the soil improved in quality from one end of the plot to the other in such a manner as to slightly favour in all cases the smaller grades, though the amount of this trifling advantage to the smaller grades could not be measured. In the present instance, the gradual variations in the soil would sometimes favour the larger grades, and sometimes the smaller. As before, these differences were quite impossible to estimate, beyond the general statement that they were so small as to be quite safely neglected, considering the extent of the trials.

In this third set of quantitive trials the amount of seed available was greater, and, in consequence, the size of the trial rows was increased, and the length in all cases, exclusive of the buffer plants at the ends, was two chains.

Only four grades of seed were used, extra large, *i.e.*, grade 325; large, *i.e.*, grade 300; medium, *i.e.*, grade 250; and small, *i.e.*, the tailings. These were in all instances planted in the order named in three or four successive rows, at the ends of the corresponding "stud plots" devoted to the production of seed wheat. This was a more satisfactory arrangement than that of the previous year. It can hardly be said, however, that this arrangement introduced any new element as compared with the first two trials, except that of omitting the use of the intermediate grades 275, 225, and 200.

The season was regarded as an average one; not so good as the previous season.

TABLE of Yields of Grain and Straw. (Third Trial.)

| No. | Sown. | Grade. | Length of row in links. | No. of plants that grew. | Lb. harvested. | | Grain. | Straw. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Grain. | Straw. | Bushels to acre. | Cwt. to acre. | |
| | | | | | *Algerian.* | | | | |
| 1 | ...... | Large .. | 200 | 181 | 1·80 | 3·08 | 7·50 | 7·70 | Compare No. 2. |
| 2 | ...... | Medium .. | 200 | 174 | 1·43 | 2·32 | 5·96 | 5·88 | ,, Nos. 1 and 3. |
| 3 | ...... | Small .. | 200 | 155 | 1·06 | 1·80 | 4·42 | 4·50 | ,, No. 2. |
| | | | | | *Allora Spring.* | | | | |
| 4 | ...... | Large .. | 200 | 163 | 1·91 | 2·20 | 7·96 | 5·50 | Compare No. 5. |
| 5 | ...... | Medium .. | 200 | 160 | 1·54 | 1·72 | 6·42 | 4·30 | ,, Nos. 4 and 6. |
| 6 | ...... | Small .. | 200 | 130 | 1·11 | 1·22 | 4·63 | 3·05 | ,, No. 5. |
| | | | | | *Australian Talavera.* | | | | |
| 7 | ...... | Very large | 200 | 185 | 2·04 | 2·68 | 8·50 | 4·70 | Compare No. 8. |
| 8 | ...... | Large .. | 200 | 193 | 1·88 | 2·92 | 7·83 | 7·30 | ,, Nos. 7 and 9. |
| 9 | ...... | Medium .. | 200 | 187 | 1·65 | 2·50 | 6·88 | 6·25 | ,, Nos. 8 and 10. |
| 10 | ...... | Small .. | 200 | 177 | 1·20 | 1·75 | 5·00 | 4·38 | ,, No. 9. |
| | | | | | *Bearded Quartzlee.* | | | | |
| 11 | ...... | Large .. | 200 | 184 | 4·90 | 6·15 | 20·42 | 12·88 | Compare No. 12. |
| 12 | ...... | Medium .. | 200 | 175 | 4·08 | 4·85 | 17·00 | 12·43 | ,, Nos. 11 and 13. |
| 13 | ...... | Small .. | 200 | 146 | 2·77 | 3·10 | 11·54 | 7·75 | ,, No. 12. |
| | | | | | *Beardless Quartzlee.* | | | | |
| 14 | ...... | Large .. | 200 | 179 | 1·90 | 2·22 | 7·92 | 5·55 | Compare No. 15. |
| 15 | ...... | Medium .. | 200 | 183 | 1·70 | 1·92 | 7·08 | 4·80 | ,, Nos. 14 and 16. |
| 16 | ...... | Small .. | 200 | 162 | 1·20 | 1·27 | 5·00 | 3·17 | ,, No. 15. |
| | | | | | *Blount's Lambrigg.* | | | | |
| 17 | ...... | Large .. | 200 | 176 | 2·04 | 2·70 | 8·50 | 6·75 | Compare No. 18. |
| 18 | ...... | Medium .. | 200 | 164 | 1·73 | 2·18 | 7·21 | 5·45 | ,, Nos. 17 and 19. |
| 19 | ...... | Small .. | 200 | 131 | 1·30 | 1·82 | 5·42 | 4·55 | ,, No. 18. |
| | | | | | *Budd's Early.* | | | | |
| 20 | ...... | Large .. | 200 | 187 | 1·60 | 1·86 | 6·67 | 4·45 | Compare No. 21. |
| 21 | ...... | Medium .. | 200 | 175 | ·80 | 1·00 | 3·33 | 2·50 | ,, Nos. 20 and 22. |
| 22 | ...... | Small .. | 200 | 153 | ·52 | ·60 | 2·17 | 1·50 | ,, No. 21. |

TABLE of Yields of Grain and Straw. (Third Trial)—*continued.*

| No. | Sown. | Grade. | Length of row in links. | No. of Plants that grew. | Lb. harvested. | | Grain. | Straw. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Grain. | Straw. | Bushels to acre. | Cwt. to acre. | |
| | | | | | *Canning Downs.* | | | | |
| 23 | ...... | Large .. | 200 | 177 | 1·43 | ·96 | 5·96 | 2·60 | Compare No. 24. |
| 24 | ...... | Medium .. | 200 | 159 | ·99 | ·65 | 4·13 | 1·63 | ,, Nos. 23 and 25. |
| 25 | ...... | Small .. | 200 | 139 | ·53 | ·40 | 2·21 | 1·00 | ,, No. 24. |
| | | | | | *Early Baart.* | | | | |
| 26 | ...... | Very large | 200 | 181 | 2·77 | 3·42 | 11·54 | 8·55 | Compare No. 27. |
| 27 | ...... | Large .. | 200 | 186 | 3·39 | 4·10 | 14·13 | 10·25 | ,, Nos. 26 and 28. |
| 28 | ...... | Medium .. | 200 | 186 | 2·89 | 3·48 | 12·04 | 8·70 | ,, Nos. 27 and 29. |
| 29 | ...... | Small .. | 200 | 146 | 1·90 | 2·28 | 7·92 | 5·70 | ,, No. 28. |
| | | | | | *Early Para.* | | | | |
| 30 | ...... | Large .. | 200 | 188 | 3·05 | 3·46 | 12·71 | 8·45 | Compare No. 31. |
| 31 | ...... | Medium .. | 200 | 187 | 1·95 | 2·12 | 8·13 | 5·30 | ,, Nos. 30 and 32. |
| 32 | ...... | Small .. | 200 | 172 | 2·10 | 2·12 | 8·75 | 5·30 | ,, No. 31. |
| | | | | | *Farmer's Friend.* | | | | |
| 33 | ...... | Large .. | 200 | 169 | 3·70 | 4·75 | 15·42 | 11·88 | Compare No. 34. |
| 34 | ...... | Medium .. | 200 | 148 | 2·90 | 3·57 | 12·08 | 8·93 | ,, Nos. 33 and 35. |
| 35 | ...... | Small .. | 200 | 132 | 2·30 | 2·74 | 9·58 | 6·85 | ,, No. 34. |
| | | | | | *Golden Drop.* | | | | |
| 36 | ...... | Large .. | 200 | 193 | 2·20 | 2·48 | 9·17 | 6·20 | Compare No. 37. |
| 37 | ...... | Medium .. | 200 | 184 | 1·75 | 1·82 | 7·29 | 4·55 | ,, Nos. 36 and 38. |
| 38 | ...... | Small .. | 200 | 150 | 1·10 | 1·48 | 4·58 | 4·70 | ,, No. 37. |
| | | | | | *Hudson's Early Purple Straw.* | | | | |
| 39 | ...... | Very large | 200 | 183 | 3·34 | 3·82 | 13·92 | 9·55 | Compare No. 40. |
| 40 | ...... | Large .. | 200 | 187 | 3·54 | 4·19 | 14·75 | 10·48 | ,, Nos. 39 and 41. |
| 41 | ...... | Medium .. | 200 | 174 | 2·78 | 2·99 | 11·58 | 7·48 | ,, Nos. 40 and 42. |
| 42 | ...... | Small .. | 200 | 165 | 2·30 | 2·51 | 9·58 | 6·28 | ,, No. 41. |
| | | | | | *King's Jubilee.* | | | | |
| 43 | ...... | Large .. | 200 | 188 | 3·38 | 3·53 | 14·08 | 8·83 | Compare No. 44. |
| 44 | ...... | Medium .. | 200 | 174 | 3·09 | 3·23 | 12·88 | 8·08 | ,, Nos. 43 and 45. |
| 45 | ...... | Small .. | 200 | 158 | 2·18 | 2·37 | 9·08 | 5·93 | ,, No. 44. |
| | | | | | *Marshall's No. 3.* | | | | |
| 46 | ...... | Very large | 200 | 183 | 2·12 | 2·18 | 8·83 | 5·45 | Compare No. 47. |
| 47 | ...... | Large .. | 200 | 181 | 2·17 | 2·28 | 9·04 | 5·70 | ,, Nos. 46 and 48. |
| 48 | ...... | Medium .. | 200 | 175 | 1·70 | 1·76 | 7·08 | 4·40 | ,, Nos. 47 and 49. |
| 49 | ...... | Small .. | 200 | 179 | 1·62 | 1·70 | 6·75 | 4·25 | ,, No. 48. |
| | | | | | *Marshall's No. 3, W.S.* | | | | |
| 50 | ...... | Very large | 200 | 190 | 2·14 | 2·30 | 8·92 | 5·75 | Compare No. 51. |
| 51 | ...... | Large .. | 200 | 179 | 1·95 | 2·07 | 8·13 | 5·18 | ,, Nos. 50 and 52. |
| 52 | ...... | Medium .. | 200 | 177 | 1·98 | 2·90 | 8·25 | 7·25 | ,, Nos. 51 and 53. |
| 53 | ...... | Small .. | 200 | 157 | 1·30 | 1·34 | 5·42 | 3·35 | ,, No. 52. |
| | | | | | *Marshall's No. 8.* | | | | |
| 54 | ...... | Very large | 200 | 186 | 2·24 | 2·68 | 9·33 | 6·70 | Compare No. 55. |
| 55 | ...... | Large .. | 200 | 186 | 2·27 | 1·82 | 9·46 | 4·55 | ,, Nos. 54 and 56. |
| 56 | ...... | Medium .. | 200 | 177 | 1·27 | 1·58 | 5·29 | 3·83 | ,, Nos. 55 and 57. |
| 57 | ...... | Small .. | 200 | 172 | 1·30 | 1·50 | 5·42 | 3·75 | ,, No. 56. |
| | | | | | *Rattling Jack.* | | | | |
| 58 | ...... | Very large | 200 | 182 | 2·31 | 2·52 | 9·63 | 6·30 | Compare No. 59. |
| 59 | ...... | Large .. | 200 | 194 | 1·87 | 2·00 | 7·79 | 5·00 | ,, Nos. 58 and 60. |
| 60 | ...... | Medium .. | 200 | 185 | 1·08 | 1·10 | 4·50 | 2·75 | ,, Nos. 59 and 61. |
| 61 | ...... | Small .. | 200 | 166 | 1·10 | 1·15 | 4·58 | 2·88 | ,, No. 60. |
| | | | | | *Red Straw.* | | | | |
| 62 | ...... | Large .. | 200 | 183 | 2·85 | 2·98 | 11·88 | 7·45 | Compare No. 63. |
| 63 | ...... | Medium .. | 200 | 175 | 2·64 | 2·79 | 11·00 | 6·98 | ,, Nos. 62 and 64. |
| 64 | ...... | Small .. | 200 | 170 | 2·30 | 2·31 | 9·58 | 5·78 | ,, No. 63. |
| | | | | | *Steinwedel.* | | | | |
| 65 | ...... | Large .. | 200 | 185 | 2·58 | 3·10 | 10·75 | 7·75 | Compare No. 66. |
| 66 | ...... | Medium .. | 200 | 188 | 2·40 | 2·70 | 10·00 | 6·75 | ,, Nos. 65 and 67 |
| 67 | ...... | Small .. | 200 | 165 | 1·69 | 1·25 | 7·04 | 3·13 | ,, No. 66. |

TABLE of Yields of Grain and Straw. (Third Trial)—*continued.*

| No. | Sown. | Grade. | Length of row in links. | No. of Plants that grew. | Lb. harvested. | | Bushels to acre. | Cwt. to acre. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Grain. | Straw. | | | |
| *Talavera de Bellevue.* | | | | | | | | | |
| 68 | ...... | Very large | 200 | 183 | 3·37 | 4·90 | 14·04 | 12·25 | Compare No. 69. |
| 69 | ...... | Large .. | 200 | 185 | 3·07 | 4·68 | 12·79 | 11·70 | ,, Nos. 68 and 70. |
| 70 | ...... | Medium .. | 200 | 170 | 2·83 | 4·40 | 11·79 | 11·00 | ,, Nos. 69 and 71. |
| 71 | ...... | Small .. | 200 | 164 | 1·99 | 3·10 | 8·29 | 7·75 | ,, No. 70. |
| *Tardent's Blue.* | | | | | | | | | |
| 72 | ...... | Large .. | 200 | 182 | 2·77 | 4·93 | 11·54 | 12·33 | Compare No. 73. |
| 73 | ...... | Medium .. | 200 | 164 | 2·67 | 4·83 | 11·13 | 12·08 | ,, Nos. 72 and 74. |
| 74 | ...... | Small .. | 200 | 154 | 1·88 | 3·90 | 7·83 | 9·75 | ,, No. 73. |
| *Velvet Pearl.* | | | | | | | | | |
| 75 | ...... | Large .. | 200 | 182 | 3·75 | 4·25 | 15·63 | 10·63 | Compare No. 76. |
| 76 | ...... | Medium .. | 200 | 167 | 3·50 | 3·85 | 14·58 | 9·63 | ,, Nos. 75 and 77. |
| 77 | ...... | Small .. | 200 | 144 | 2·30 | 2·45 | 9·58 | 6·13 | ,, No. 76. |
| *White Essex.* | | | | | | | | | |
| 78 | ...... | Very large | 200 | 188 | 1·70 | 2·12 | 7·08 | 5·30 | Compare No. 79. |
| 79 | ...... | Large .. | 200 | 194 | 1·40 | 1·73 | 5·83 | 4·33 | ,, Nos. 78 and 80. |
| 80 | ...... | Medium .. | 200 | 186 | 1·40 | 1·88 | 5·83 | 4·70 | ,, Nos. 79 and 81. |
| 81 | ...... | Small .. | 200 | 177 | 1·20 | 1·58 | 5·00 | 3·95 | ,, No. 80. |
| *White Lammas.* | | | | | | | | | |
| 82 | ...... | Very large | 200 | 189 | 2·48 | 3·20 | 10·33 | 8·00 | Compare No. 83. |
| 83 | ...... | Large .. | 200 | 196 | 2·38 | 3·17 | 9·92 | 7·93 | ,, Nos. 82 and 84. |
| 84 | ...... | Medium .. | 200 | 186 | 1·63 | 2·10 | 6·79 | 5·25 | ,, Nos. 83 and 85. |
| 85 | ...... | Small . | 200 | 172 | 1·65 | 2·05 | 6·88 | 5·13 | ,, No. 84. |
| *White Naples.* | | | | | | | | | |
| 86 | ...... | Very large | 200 | 148 | 2·60 | 3·84 | 10·83 | 9·60 | Compare No. 87. |
| 87 | ...... | Large .. | 200 | 135 | 2·30 | 3·50 | 9·58 | 8·75 | ,, Nos. 86 and 88. |
| 88 | ..... | Medinm .. | 200 | 138 | 2·20 | 3·37 | 9·17 | 8·43 | ,, Nos. 87 and 89. |
| 89 | ...... | Small .. | 200 | 119 | 1·50 | 2·35 | 6·25 | 5·88 | ,, No. 88. |
| *White Tuscan.* | | | | | | | | | |
| 90 | ...... | Large .. | 200 | 181 | 2·28 | 2·47 | 9·50 | 6·48 | Compare No. 91. |
| 91 | ...... | Medium .. | 200 | 183 | 1·88 | 2·28 | 7·83 | 5·70 | ,, Nos. 90 and 92. |
| 92 | ...... | Small .. | 200 | 155 | 1·35 | 1·60 | 5·63 | 4·00 | ,, No. 91. |
| *White Velvet.* | | | | | | | | | |
| 93 | ...... | Large .. | 200 | 166 | 2·50 | 2·80 | 10·42 | 7·00 | Compare No. 94. |
| 94 | ...... | Medium .. | 200 | 157 | 2·81 | 3·06 | 11·71 | 7·65 | ,, Nos. 93 and 95. |
| 95 | ...... | Small .. | 200 | 116 | 1·60 | 1·80 | 6·67 | 4·50 | ,, No. 94. |
| *Zealand.* | | | | | | | | | |
| 96 | ...... | Very large | 200 | 184 | 1·09 | 1·92 | 4·54 | 4·80 | Compare No. 97. |
| 97 | ...... | Large .. | 200 | 195 | 1·10 | 1·40 | 4·58 | 3·50 | ,, Nos. 96 and 98. |
| 98 | ...... | Medium .. | 200 | 191 | 1·02 | 1·34 | 4·25 | 3·35 | ,, Nos. 97 and 99. |
| 99 | ...... | Small .. | 200 | 187 | ·92 | 1·23 | 3·83 | 3·08 | ,, No. 98. |

SUMMARY of Growth. (Third Trial.)

The rate of germination and growth is shown by the fact that:—

Out of 2,400 grains of the extra large or 325 grade 90·0 per cent. grew.
,, 5,800 ,, large or 300 ,, 90·9 ,,
,, 5,800 ,, medium or 250 ,, 87·0 ,,
,, 5,800 ,, small or tailings 77·8 ,,

by which is meant that this percentage of the grains produced plants that could be cut and weighed, though the plants did not in all cases produce seed. The harvesting was done as in the previous set. As before, the straw was tied up and weighed in the field, where it rested on the ground. It is therefore necessary to call attention to the fact that the straw may not have been in *precisely* the same condition of dryness in the two years, and that therefore this fact should be borne in mind in any attempt to compare the results of the one year with the other. I have full confidence that any difference due to this cause may be safely neglected, but there is no experimental or other proof of this. In both cases the weighings were made during a spell of dry weather. In both cases all the weighings of straw were made and checked during the middle part of one and the same day so as to eliminate any chance of error due to the hygroscopic qualities of the straw.

In the weighings and in the previous care of these trials I had the highly valued aid of my assistant, Mr. E. M. Grosse, as well as that of Mr. R. Hirst who, under the training of the farm management, had become a very useful workman.

The plots were under the general charge of Mr. George Valder, whose devoted interest was of great value, not only in securing accurate supervision, but also in spreading an interest in the work by calling the particular attention of many hundreds of visitors to the facts ocularly demonstrated by the trials.

### SUMMARY of Comparisons. (Third Trial.)

If we take as the yield of each trial the sum of the weights of the grain and of the straw, we find that in general the various grades have exceeded in their productiveness the smaller grades with which they have been compared, so that if we class the trials according to the larger of the grades used in the comparison, we may make the following general statement :—

The very large or 325 grade excelled in 66·7 per cent. of the trials.
,, large or 300 ,, in 89·7 ,, ,,
,, medium or 250 ,, in 93·1 ,, ,,

This statement, however, fails as in the previous trials to tell the whole story, for the reason that the excess of yield in the majority cases is much greater than in the minority cases. Thus,

The very large or 325 grade when excelling did so by 14·7 per cent. ; if excelled it was by only 8·5 per cent.
The large or 300 grade when excelling did so by 30·4 per cent. ; if excelled it was by only 12·3 per cent.
The medium or 250 grade when excelling did so by 44·5 per cent. ; if excelled it was only by 3·5 per cent.

In these statements the basis of the percentage calculation is the weight of the yield of the lower of the two contestants.

If instead of taking the sum of the weights of the grain and straw as the criterion of yield, we take the weight of the grain alone, we arrive at the following :—

The very large or 325 grade excelled in 58·3 per cent. of the trials.
,, large or 300 ,, in 93·1 ,, ,,
,, medium or 250 ,, in 86·2 ,, ,,

As before, we find, however, that the victories of the large seed are more decisive than those of the small seed, and this must be taken into account in estimating the superiority of the larger grades. We find that :—

The 325 grade when excelling did so by 12·9 per cent.; when excelled it was only by 6·6 per cent.
The 300 grade when excelling did so by 26·5 per cent.; when excelled it was only by 7· per cent.
The 250 grade when excelling did so by 40·5 per cent.; when excelled it was only by 3·3 per cent.

If instead of taking the sum of the weights of the grain and straw as the criterion of yield, we take the weight of the straw alone, we arrive at the following :—

The very large or 325 grade excelled in 66·7 per cent. of the trials.
,, large or 300 ,, in 89·7 ,, ,,
,, medium or 250 ,, in 93·1 ,, ,,

But here, again, we find that the victories of the large grades are much more decisive than those of the small grades, and this must not be forgotten in estimating the superiority of the large grades. Examination of the tables proves that :—

325 grade when excelling did so by 19·2 per cent.; when excelled it was only by 10·8 per cent.
300 grade when excelling did so by 29·6 per cent.; when excelled it was only by 19·4 per cent.
250 grade when excelling did so by 40·7 per cent.; when excelled it was only by 4·5 per cent.

The land on which the trials were carried out was newly cleared land that had never before been cropped. It had been ploughed up some little time before sowing, but it was not in first-class condition for wheat-growing. It was too green and it was too patchy.

There was no attempt made to secure any particular yield. A higher yield might have been obtained by placing the drills nearer together, but this would have greatly increased the labour of attending to the weeds, as a workman would be too cramped among rows so near together, and would have had to work more slowly, and there would have been a larger number of accidents.

## FOURTH TRIAL.

TABLE of Yields of Grain. (Fourth Trial.)

| No. | Sown. | Grade. | Length of row in links. | No. of Plants that grew. | Lb. harvested. | | Bushels to acre. | Cwt. to acre. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Grain. | Straw. | | | |
| | | | | | *Hudson's Early Purple Straw.* | | | | |
| 1 | June .. | Large .. | 400 | .... | 4·96 | .... | 10·33 | .... | Compare No. 2. |
| 2 | ,, .. | Medium .. | 400 | .... | 4·16 | .... | 8·67 | .... | ,, Nos. 1 and 3. |
| 3 | ,, .. | Small .. | 400 | .... | 3·32 | .... | 6·92 | .... | ,, No. 2. |
| | | | | | *Allora Spring.* | | | | |
| 4 | June .. | Large .. | 400 | .... | 3·60 | .... | 7·50 | .... | Compare No. 5. |
| 5 | ,, .. | Medium .. | 400 | .... | 3·52 | .... | 7·33 | .... | ,, Nos. 4 and 6. |
| 6 | ,, .. | Small .. | 400 | .... | 2·06 | .... | 4·29 | .... | ,, No. 5. |
| | | | | | *White Velvet.* | | | | |
| 7 | June .. | Large .. | 400 | .... | 3·98 | .... | 8·29 | .... | Compare No. 8. |
| 8 | ,, .. | Medium .. | 400 | .... | 4·45 | .... | 9·27 | .... | ,, Nos. 7 and 9. |
| 9 | ,, .. | Small .. | 400 | .... | 3·17 | .... | 6·60 | .... | ,, No. 8. |

## DISCUSSION OF THE VARIOUS TRIALS.

In these experiments the trial was always made between equal numbers of seeds. This is of course a different matter from trials between equal bulks of seed, or between equal weights of seed. As stated elsewhere, the reason for adopting the present method was that the method usually practised in improving wheat for seed is that of grading by means of sieves, and the grades thus secured are, as nearly as practice allows, simply seeds of so many different sizes. It seemed, therefore, that it was the relative value as seed of equal numbers of these sizes that it would be most useful to know.

In order to give data by means of which it will be possible to, in some measure, reason from one system of comparison to another, I have graded some samples of wheat and counted the grains in equal bulks, and also weighed equal numbers of seeds. These comparisons have given the following results:—

NUMBER of Grains contained in equal weights of Purple Straw Seed-wheat of various Grades.

| Grade. | 3·25 | 3·00 | 2·75 | 2·50 | 2·25 | 2·00 | *Tailings. |
|---|---|---|---|---|---|---|---|
| No. of grains .. .. .. | 348 | 369 | 402 | 463 | 579 | 715 | 1,000 |

NUMBER of Grains contained in equal volumes of Seed-wheat of various Grades.

| Grade. | 3·25 | 3·00 | 2·75 | 2·50 | 2·25 | 2·00 | *Tailings. | Variety Name. |
|---|---|---|---|---|---|---|---|---|
| No. of grains .. .. .. | 381 | 408 | 459 | 550 | 684 | 793 | 1,000 | Purple Straw. |
| ,, .. .. .. | 303 | 313, | 355 | 441 | 587 | 736 | 1,000 | Allora Spring. |
| ,, .. .. .. | 284 | 311 | 372 | 463 | 585 | 731 | 1,000 | Hudson's E. P. Str. |

From these figures we may derive the following approximate statements, which are easily carried in the mind:—

1. The 2·50 grade—that is, the medium grade—contains half as many grains in a given volume as the tailings.
2. The 3·25 grade—that is, the largest grade—contains one-third as many grains in a given volume as the tailings.

---

* These tailings contained no split grains, "white-heads," or dirt.

### *Poor Quality of Crops from Small and Shrivelled Seed.*

Bearing these facts in mind, we have now to consider a question of some importance, and that is the relative value of the grain crops from large and small grains, irrespective of the weights or sizes of the crops. Are the crops obtained from small seeds as good in quality as those from large seeds? It appears that this question is one that has been seldom thought of, and it is one that has not been satisfactorily tested, so far as I am aware.

It will be seen from the tests conducted with reference to the absolute value of large and small grains from the same ear of wheat that there is some ground for considering the two of about equal fodder value. This is a different matter from the comparison of large and small grains from different plants, and it differs still more widely from the comparison of large and small grains that are from different plants which are different in size and in the size of their grains, because of their having sprung from large and small seed respectively. It may not be wholly profitless, however, to discuss this question even on this somewhat remote experimental basis, especially as it will be seen that the structure of the grains of small size, as connected with their value as fodder, is such in the comparison cited that it seems reasonable to suppose the same structure would enter into small grains of any sort; I refer to the thinness of the bran, and the relative proportion of flour, &c.

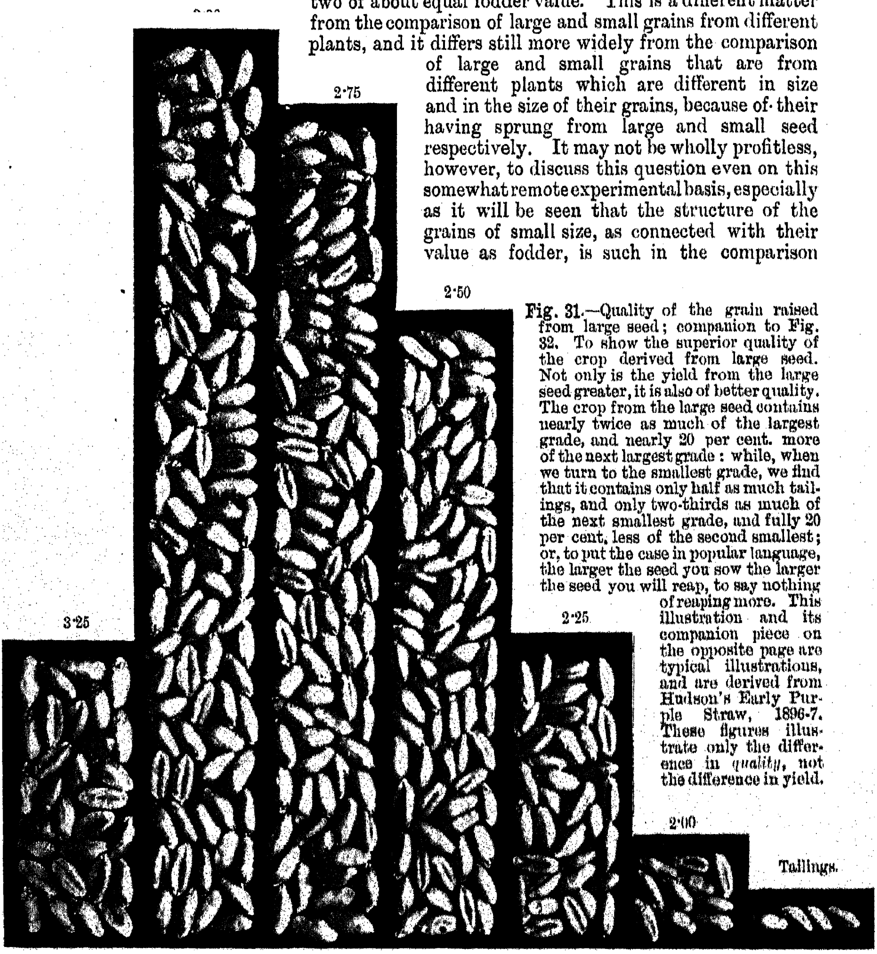


**Fig. 31.**—Quality of the grain raised from large seed; companion to Fig. 32. To show the superior quality of the crop derived from large seed. Not only is the yield from the large seed greater, it is also of better quality. The crop from the large seed contains nearly twice as much of the largest grade, and nearly 20 per cent. more of the next largest grade: while, when we turn to the smallest grade, we find that it contains only half as much tailings, and only two-thirds as much of the next smallest grade, and fully 20 per cent. less of the second smallest; or, to put the case in popular language, the larger the seed you sow the larger the seed you will reap, to say nothing of reaping more. This illustration and its companion piece on the opposite page are typical illustrations, and are derived from Hudson's Early Purple Straw, 1896-7. These figures illustrate only the difference in *quality*, not the difference in yield.

If this be so, then the absolute feeding value of crops of grain from large and from small seed would be about equal, weight for weight.

As to the market value, however, the case stands differently, for if the crop of grain from small seed is smaller in size than from large seeds, its market value will be smaller for two reasons. First, the small size of the grains will lower the market value irrespective of the use to which it is to be put, the buyer (really representing the miller) always preferring the sample that presents the better appearance. Again, though this is admittedly but another phase of the same idea, the miller gives to small grains an inferior milling value, and this leads to a lower price in proportion to the number of small grains in the sample, said small grains putting the miller to the expense of their removal and separate disposal.

How do the crops from large and small grains compare with each other with reference to the size of the grains? Are the grains in the crop from large seed, larger or smaller than in the crop from small seed? I am able to answer that the crops from the smaller seeds do not grade up so well as those from the larger seeds, but I am sorry not to be able to go further than this. The men at work upon this problem were removed from the work, and the full results were never obtained. This serious loss I am only able to counteract by the statement that, from "general observation" and a few trials, I feel sure that the crops from the smaller seeds are nearly always, if not always, from a market point of view, inferior to those from the larger seeds. Let anyone look at the illustration on page 148, which is entirely typical of the results of these trials, and he will not be surprised to hear the opinion expressed that the plants in the row planted with small seeds yielded not only less grain, but that the grain yielded was of smaller size, and hence of lower market value.

The best I can do in this connection is to apologise, and express regret that such an obvious question, and one whose answer was actually in hand, should have been allowed to go partially unanswered.

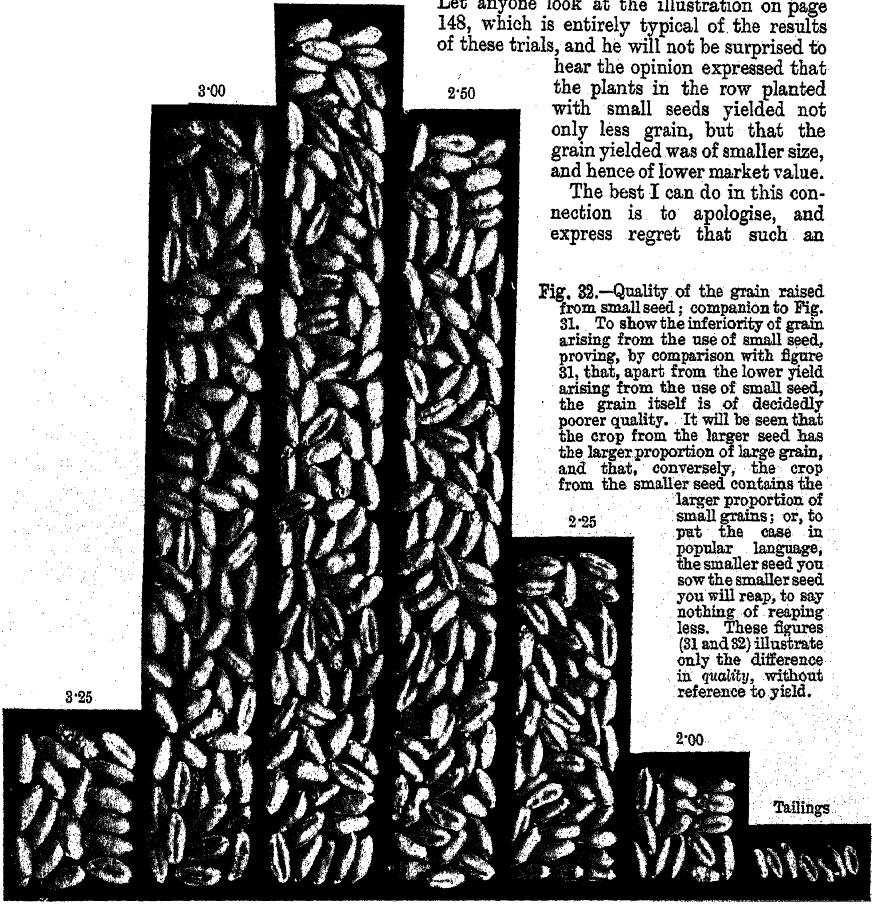


Fig. 32.—Quality of the grain raised from small seed; companion to Fig. 31. To show the inferiority of grain arising from the use of small seed, proving, by comparison with figure 31, that, apart from the lower yield arising from the use of small seed, the grain itself is of decidedly poorer quality. It will be seen that the crop from the larger seed has the larger proportion of large grain, and that, conversely, the crop from the smaller seed contains the larger proportion of small grains; or, to put the case in popular language, the smaller seed you sow the smaller seed you will reap, to say nothing of reaping less. These figures (31 and 32) illustrate only the difference in *quality*, without reference to yield.

In spite of this I am glad to be able to say I have evidence that the grain yielded from plants grown from small and shrivelled seed is almost invariably inferior from a grading point of view, and that the difference is a very perceptible one—one such as to lower the market value of the grain. It will be seen from the adjacent figures and illustrations that the evidence assembled is of an unmistakable character, in spite of the fact that I am unable at the present time to give averages for several years such as alone can establish a perfectly satisfactory basis for practice. (See Figs. 31 and 32.) The examples cited are typical ones, but I cannot be certain how near they are to being average cases. The grading and the illustrations prove that there is a pronounced difference in the quality of the grain-crops from large and small seeds, the balance being in favour of the large grain. The illustrations represent equal quantities of grain; that is, there is the same bulk of grain shown in Fig. 31 as in Fig. 32. The quality of the grain shown in Fig. 31 is manifestly the better.

The figures and illustrations do not tell the whole story, however, for apart from the manner in which the samples grade up there is the difference in the appearance of the samples. The sieves separate the grains according to size alone, taking no account of plumpness. As a matter of fact, when two samples, one grown from small seed and the other from large seed, are placed side by side, it is usually possible to see that the sample derived from the large seed is the plumper and better sample. The difference is a rather small one, but is usually distinctly perceptible, and is one that would not be overlooked by an experienced buyer of wheat.

This defect in plumpness has to be added to that of size shown in the illustrations to fully appreciate the inferior market quality of the grain derived from small seed.

*Hence we have in a grain-crop derived from small seed not only a lower yield of grain, but a decided inferiority in quality.*

As might be expected from all this, the weight per bushel of the grain crop from small seed is less than that from large seed. As derived from numerous tests made during these experiments the difference is a small one, but it is very constantly in favour of the crop derived from the large grain, which is found to weigh from a small fraction of a pound up to a pound a bushel more than that derived from the small grain.

TABLE SHOWING SUPERIORITY OF CROPS OF GRAIN FROM PLANTS FROM LARGE SEED.

| Grade. | White Velvet. | | | Allora Spring. | | | Hudson's Early Purple Straw. | | |
|---|---|---|---|---|---|---|---|---|---|
| | Large. | Medium. | Small. | Large. | Medium. | Small. | Large. | Medium. | Small. |
| | % | % | % | % | % | % | % | % | % |
| 3·25 | 18·6 | 13·9 | 12·4 | 11·2 | 6·6 | 9·1 | 17·4 | 11·9 | 12·3 |
| 3·00 | 34·4 | 38·7 | 27·7 | 32·1 | 27·5 | 26·7 | 40·1 | 38·7 | 38·7 |
| 2·75 | 32·2 | 31·6 | 38·1 | 39·3 | 47·5 | 45·0 | 27·8 | 31·0 | 30·4 |
| 2·50 | 12·7 | 12·6 | 17·0 | 15·2 | 15·7 | 17·0 | 11·9 | 13·6 | 13·7 |
| 2·25 | 1·5 | 2·3 | 3·7 | 1·7 | 1·9 | 1·5 | 2·1 | 3·8 | 3·4 |
| 2·00 | ·3 | ·6 | ·9 | ·4 | ·4 | ·3 | ·5 | ·7 | ·9 |
| Tailings. | ·2 | ·2 | ·3 | ·3 | ·2 | ·4 | ·2 | ·4 | ·5 |

In this table the three crops of grain are arranged under the variety name in three columns—the crop from the large seed in the first column, the crop from the medium-sized seed in the second column, the crop from the small seed in the third column. Thus, under the name White Velvet, we find three columns, entitled large, medium, small. In the first column, opposite each grade number, will be found the percentage by weight of that grade in the sample of grain yielded from the planting of large seed. Similar results are found in the second and third columns for the crops from the plantings of medium-sized and small seeds. Reading horizontally in the three columns, it will be seen that the sample yielded from the planting of large seed contained 18·6 per cent. of the 3·25 grade; while the sample from the medium seed contained only 13·9 per cent.; and the sample from the small seed only 12·4 per cent. Similar figures are tabulated for the other varieties, *i.e.*, Allora Spring and Hudson's Early Purple Straw.

These figures, showing the greater proportion of large grains in the crops raised from large seed, are indicative of a higher market value for those crops. It is not necessary to grade the samples in order to detect this difference, as it can be easily seen at a glance. The grading, however, enables us to measure the difference and show that just in proportion as the seed is large and plump so will be the predominance of large seed in the progeny.

### *Tailings Used in the Trials Better than Ordinary Tailings.*

In making comparisons between the results recorded in these pages and the results to be obtained from the practice of sowing tailings, or in other words, sowing small and shrivelled seed, it is necessary to keep in mind that the seed here experimented with was in all cases whole seed, none of it was cracked or split or unhealthy. On the other hand, the samples of small and shrivelled seed that have been used and lauded, or at least excused in practice, usually contain a considerable proportion of split, diseased, and useless material. This is due to the fact that the wide use of the stripper leaves in our wheat a considerable proportion of split grains, and these accumulate in the tailings. Examinations I have made lead me to the conclusion that 10 to 20 per cent. of the tailings, such as are not unfrequently kept and used for seed purposes, is composed of split grains that are valueless as seed. Such split grains, together with other diseased, useless, and more or less foreign matter, occasionally compose 30 to 40 per cent. of the bulk of the tailings from ordinary cleaning machinery.

These observations, which are based on actual counts of measured quantities of tailings, throw considerable light upon the contention frequently heard from those who advocate or condone the use of poor quality seed-wheat,—the contention, namely, that although the seeds are smaller in these tailings there are so many more of them that their small size is made up for by this increase in numbers,—for it must be remembered that the apparent increase in the number of seeds in ordinary tailings, due to the smaller size of the seeds, has to be diminished by the bulk of this worthless and foreign matter before we arrive at the true number of seeds, and that this diminution amounts in different samples to from 5 to 40 per cent. From my observations and measurements I should be inclined to set the average at somewhere between 10 per cent. and 20 per cent.

This allowance has to be made before beginning to compare the results of these experiments with the arguments advanced for using tailings as seed, for the small and shrivelled seed in all these trials was freed from such split and foreign matter. Every seed sown was a perfect seed of the size set down in the photographs of tailings (Figs. 10, 14, 21, 22, 31 and 32), and had the advantage in all cases of being derived from healthy plants. None of the small and shrivelled seed used in these trials could have been derived from plants diseased in any manner except from attacks of rust. In certain instances, seed was purposely selected from plants that had suffered from rust, but such cases do not compose more than a small percentage of the trials. It is almost impossible to secure plants absolutely free from rust; so that in nearly all cases the plants furnishing the seed bore a very small quantity of rust, but it was a very small quantity indeed in the great majority of cases. The healthiness of the tailings used in these trials comes about from the fact that the seed for the experiments was derived from the plants selected out of a large number as being the best for seed purposes. The selection was made by examining each plant most carefully, diseased and imperfect plants being rigidly excluded, except in the cases mentioned.

It will therefore be seen that it is impossible to attribute the results of the trials recorded in the tables to diseased seed. If any suggestion can be entertained in this connection it is that the germination and growth here recorded is higher than would be the case with ordinary seed-wheat. I cannot help believing that here again the conditions of the trials favour the small seeds as compared with ordinary practice, because I have come to the conclusion that the diseased seeds that are not unfrequent in ordinary seed-wheat accumulate in ever increasing number in the smaller grades, so that, for instance, if an ordinary sample of wheat be cleaned and graded, its diseased seed will appear in greater percentage in the smaller grades, simply for the reason that such diseased seeds are of smaller size than their healthy companions. This conclusion is one that I have formed from the examination of a large number of examples of seed-wheat, and I think, inasmuch as the seed of small size used in these trials was almost invariably derived from most carefully selected healthy plants, that the germination and growth displayed by them is in excess of what would be found in ordinary practice.

The weight per bushel of the small grains of a given sample is less than that of the large grains from the same sample.

These facts furnish the basis for instructive comparisons with the relative yields given in the tables of trials of large and small grains.

*(To be continued.)*

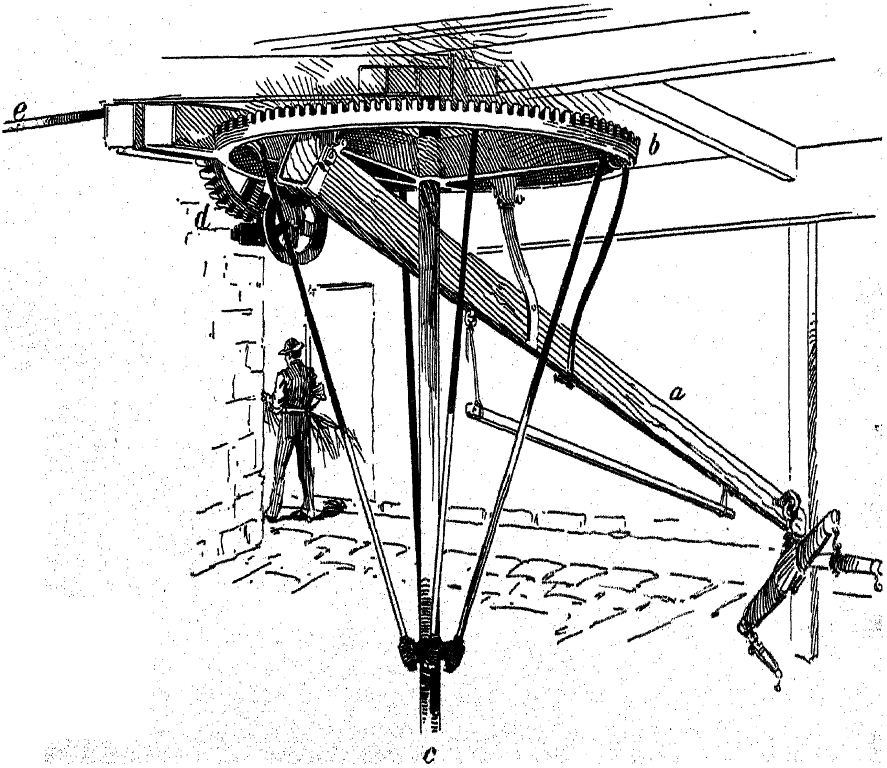
## TREATMENT OF WITHERED MAIZE.

WHERE the stalks of scorched maize are still in a juicy condition, the crop can be converted into ensilage as advised in another part of this issue. But where not only the flag, but the stalk also, has been dried out, it will not be possible to successfully adopt ensilage as a means of conservation. Such withered crops can best be converted into hay. Curing is effected very much in the same manner as in the case of oaten hay if plenty of labour is available. If the hands are few, the stalks might be made up into handy sheaves and stooked in piles of about a dray load. If weather conditions should prove favourable, the maize-hay will be perfectly dry in four or five days, and may be stacked or even baled. Should it be necessary to store before the hay is quite dry, the sheaves should be stacked on a scaffold or loosely in such a way that air may penetrate the heap.

# A Handy Horse-Power.

N. A. COBB.

HEREWITH is presented an illustration of a horse-power as used in a well-known Danish dairy-school. It is of a form seldom or never seen in this State. The manner of attachment of the horse to the driving-gear is plainly shown in the drawing. The driving-gear (*b*), however, is overhead instead of under foot, being attached to a vertical shaft which has an anti-friction bearing in the floor below *c*. The cog-wheel worked by the driving-gear (*b*) is not shown, but a larger gear on the same shaft is shown at (*d*). This gear works a cog-wheel (also not in view) on the shaft (*e*), which passes into the dairy to work the separators, &c. The apparatus ran smoothly and appeared to have answered its purpose well for a long time. The horse always works under cover, and the flag floor is left comparatively free of machinery. There appeared to be a smaller loss of power than usual, due to the peculiar action of the lever.



# HAWKESBURY AGRICULTURAL COLLEGE AND EXPERIMENTAL FARM.

## MAIZE ENSILAGE.

H. W. POTTS.

IN many of the principal maize districts an unusual situation has been created by the disastrous heat wave which passed over the State during the early part of last month. The main maize crops which were growing most luxuriantly had reached the tassel stage, and the scorching temperature, accompanied by high winds, affected the plants to such a degree as to destroy in all but exceptionally favoured situations any prospect of a grain yield.

The most profitable manner of disposing of crops in such a condition will be to convert the stalks into ensilage. There is, unfortunately, a prospect of a considerable shortage of winter fodder; and, therefore, in this form of food conservation at this juncture, there are great possibilities. Maize ensilage has proved repeatedly to be one of the cheapest as well as the most satisfactory of winter foods for cattle, horses, and sheep. Those farmers who have been in the habit of converting a portion of their maize crops into silage each year will, no doubt, find little difficulty in coping with the matter. Those who have not before been confronted with such a problem will find the situation rather awkward, and for their guidance I would like to offer the following hints:—

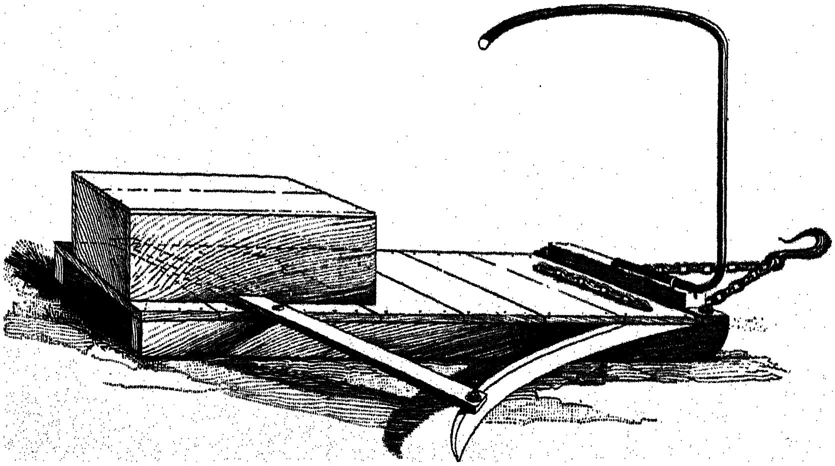
Several effective methods can be adopted to make stack ensilage. These can only be determined by local conditions. In all cases provision should be made to render the stack weather-proof from the top to exclude rain. If a shed be used, with a good floor and well drained, a space 16 x 14 will provide for 100 tons with a stack 22 to 24 feet high. The crop should be stacked immediately after cutting. In the operation of stacking, care should be observed to pack tightly, level, and evenly throughout, the great aim being to exclude air, and when the stack settles down it will shrink evenly throughout. Otherwise the air will be admitted, and the requisite fermentative changes checked, and waste follows.

When the top is reached, some weighing must be added, the character of which again must be decided by whatever material is most handy and economical. Posts and rails, sleepers, logs, stones, or any heavy material that is not liable to shift when the action of shrinking sets in may be used. Some guidance as to quantity may be taken from the rough estimate that it requires from 1½ cwt. to 2 cwt. per square foot of surface. Finally this weight material should be made rain-proof.

In some instances it may be expedient to build stacks in the paddocks where the maize is grown. Care should be exercised in selecting a well-drained site. Soil may be used to weight the stack, but in using this special precautions should be taken to secure a level, evenly-balanced surface.

The approximate estimate of the food value of maize as ensilage in its best form is that 3 tons equals 1 ton of oaten hay. Under ordinary circumstances, an acre of maize will produce ensilage equivalent to 3 to 4 tons of oaten hay. It has to be remembered that in the stack form of ensilage there is a good deal of waste through sides becoming dry and indigestible. Often from 12 to 15 inches all round is thus affected. The larger the stack the less waste will be found, and the more complete is the fermentative changes on which the relishable and nutritive qualities of this stock food so much depend.

A cheap and quick system of cutting the maize is essential, and the cornstalks may be harvested by means of a simple device, which can be readily constructed by any handy man on a farm, as shown in the accompanying illustration. A farm sledge is made 3 ft. 6 in. x 20 in. by upright 3 in. x 2 in. timbers as a framework on which is nailed 1 inch hardwood boards. To the right-hand corner affix the blade of an ordinary scythe by passing a bolt through its heel. Drill a hole about 6 inches or 8 inches from the point of the scythe through the blade, into which a bolt is passed and secured to a 3 in. x 1 in. batten. The



length of this is regulated to give the blade an angle of 45 degrees from the side of the sledge. This cross batten is transfixed to the sledge by bolts being passed through the floor and side battens of the sledge on each side. When all three bolts are evenly screwed up, the scythe blade is rendered quite rigid and firm.

A steady horse accustomed to cultivation between rows of corn should be harnessed to the sledge. The driver sits on a kerosene case or raised framework. One hand is used to drive, and the other guides the fall of the stalks. These should be cut close to the roots. This plan is simple and rapid in its work. From 5 to 8 acres per day can be cut in this way. As the maize is cut the stalks should be gathered into bundles and carted to the stack.

## HAWKESBURY DISTRICT FARM NOTES.—FEBRUARY.

### H. W. POTTS.

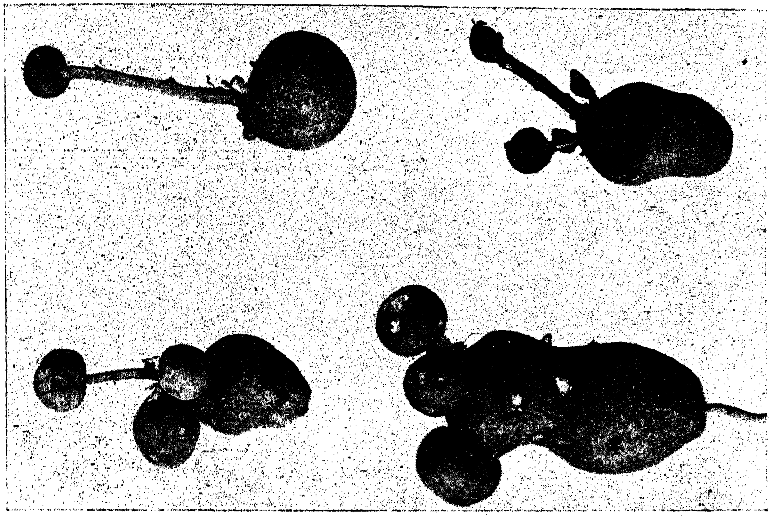
IF the dry weather continues all growing crops will need unremitting attention in the way of cultivation to conserve every particle of available moisture in the soil. Where the grass is rapidly going off inroads may have to be made into the supplies of green fodder intended for conservation for winter use. In the case of sorghums and millets a fairly good second growth may be expected. To ensure this it is well to top-dress the cut crops, using about 1 cwt. of fertiliser per acre.

Land should now be made ready for cropping—at intervals of (say) a fortnight—with wheat or barley mixed with tares to provide a succession of green fodder for winter use. The varieties of wheat which produce the heaviest green crops in the coastal districts are usually those like Medeah and Algerian, with a beard which in the matured stages becomes very harsh. The same applies to barley, although the skinless variety which is found to do well in some of the coastal districts is, like the Lammas and Talawera wheats, without a beard. Barley is a rather dainty crop and will not thrive in cold, hungry soils. The best results are to be obtained in ground that has been enriched with farmyard manure, and where the drainage is as nearly perfect as possible. For the poorer lands rye is a more satisfactory crop, and if it is sown with tares during this month good crops may be obtained. For green feed on a small scale oats may now be sown. Some farmers prefer to put in oats later in the season, but if there should happen to be some odd patch of ground available it would be just as well to sow it at the first opportunity, applying with the seed superphosphate or bonedust at the rate of about 1 cwt. per acre. Where the land is ready no time should be lost in getting in a good breadth of turnips and swedes. The latter will generally be found to be most profitable in the coastal districts. According to the quality of the soil from 2 to 4 cwt. of bonedust or superphosphate per acre will be required to ensure profitable crops. In case that the season remains dry, plenty of house room should be left so that the young plants may be assisted by frequent cultivation of the soil.

As a catch crop for sowing at this time there is scarcely anything to excel rape. Sown either broadcast or in drills with a dusting of fertiliser to give the plants a start it will within a very short space of time produce an abundant supply of nutritious feed for sheep, pigs, and dairy cattle. With a little management the crop can be grazed for several months and the area thus benefited by the dropping of the depastured animals as well as by the deeprooting habit of the rape. Field cabbage and kale are also worthy of a place in the bit of green foder that becomes available when the paddocks are at their worst.

## POTATOES SPROUTING IN THE GROUND.

THE potato crop in this district is a partial failure, most probably the reason being the erratic nature of the rainfall. Planting was conducted after an exceptionally dry time; the ground was parched. Following this we had a series of rains in rapid succession, in warm weather. Plant growth was forced at an abnormal pace; the tops grew inordinately, whilst the tubers which formed exhibited a marked tendency to sprout, as seen in the accompanying illustration. Similar experience is recorded by the farmers along the Hawkesbury. The tubers illustrated were grown in fairly good soil, manured well with farm-yard manure and cultivated thoroughly. Prior to planting, it was noticed that the subsoil was very dry, and this continued until the rains of November and December.



It may readily be recognised that such growths and conditions are the results of the unfavourable weather conditions which prevailed during the past year. Potatoes display a marked susceptibility to such, as evidenced in this case.

## Sorghum Hay.

In November Farm Notes for the Hawkesbury District, Mr. Potts advised dairy-farmers and others having to provide winter and early spring fodder, to go in for sorghum hay. To show how highly this forage is appreciated when farmers have got into the knack of curing it, the following extracts are reproduced from an article by Mr. H. S. Miller, of Osage, in the last Biennial Report of the Kansas State Board of Agriculture. It might be mentioned that the climatic conditions of Kansas are rather like those of New South Wales—hot, dry summers, and comparatively mild winters.

Mr. Miller grows on his ranch from 250 to 400 acres of sorghum annually, adopting a rotation system of farming as nearly as possible. Of the way to harvest sorghum he says: "We have used self-rake reaping machines in cutting our sorghum, throwing it to the side in loose bunches, afterwards gathering up by hand, and shocking as we would corn. This is a very good way to keep the feed bright and prime, but requires too much work. After the sorghum has lain in bunches a short time it settles among the stubble, 4 or 5 inches high, and it is too slow a process to gather it up by hand and put in shocks, and requires a lot of help at a time when assistance is scarce and hard to get. We try to economise in labour as well as in other expenses, so we use our mowing machines and self-dumping rakes, as in cutting and stacking ordinary hay, except, instead of putting the sorghum in windrows, we bunch two or more rakesful, then rake enough to this bunch to make from 600 to 1,200 lb., having men to take each rake-load as it is dumped, and make a shock built to turn rain and withstand storm. This is the cheapest plan, and if properly and carefully followed in season, the fodder will keep fully as bright and green until fed out during the winter as if put in shock from the dumping rake. I think what we need for harvesting this crop is an open-end binder, built in all its parts strong enough to stand the heavy work required of it, so that we can cut, bind, and shock sorghum as we do wheat or maize. This has been contemplated by manufacturers, but up to this time such machines have not been placed on the market that I know of."

Mr. Miller does not think it is worth while cutting immature sorghum for curing. He prefers the saccharine varieties, and likes to have the seed well developed, and the flag just tinged with yellow before cutting and harvesting.

"Sorghum," he adds, "should be put in shock as soon after cutting as possible. What I mean by this is that only a few hours are necessary to wilt it, as we do clover, when it is in good condition to be put in shocks. Of course, I would have the conditions favourable—barring dampness, cloudy weather, evening rains, and morning dews. Its greatest value is retained by keeping it green and bright as it would be if kept in a silo. When put in shocks of the size mentioned, sorghum will not become mouldy from its own moisture, and if things are done in the manner indicated, there is no danger of artificial dampness spoiling it. Again, shock it as we would corn or Timothy hay in the meadow to cure before putting in the barn. I might not be so ready to explain why; but, nevertheless, it is true that sorghum left long in the sun to dry deteriorates in value just as Timothy hay does. The stalks become woody, and the blades parched. After being cut twenty-four to forty-eight hours, much of the real value deteriorates in proportion to the time it remains in the swath subject to the hot sun during the day, and possibly showers or heavy dews at night.

"I have spoken of sorghum as a feed for stock from the light of my own experience, based on practical tests during the many years it has been grown and fed on our ranch.

"Saccharine sorghums—(Early Amber cane, Planter's Friend, Black African)—when properly grown produce from 5 to 12 tons of feed to the acre. We feed it in our pastures when the grass commences to dry in the fall (autumn); in racks in our corrals during the winter; and if we could raise enough of it for the supply to hold out, or would keep a less number of cattle, I think we could feed the cured sorghum with equal profit as pasture in spring before the grass is sufficient to keep cattle from losing flesh. Sow sorghum occasionally in the maize land, and if possible use a leguminous crop in the rotation. The land will be all the more productive as a result of the rotation."

Miss Mary Best, another Kansas authority on sorghum as a forage on a very large scale, says: "For hay, cut the drilled cane as soon as the seed is in the dough, and rake into windrows within twenty-four hours. Before another sun sets have it in cocks of 1,000 to 2,000 lb., well topped out."

# Farm Notes.

## BATHURST DISTRICT.—February.

R. W. PEACOCK.

December, with its frequent showers, has been followed by a disastrously dry month, which has injured severely the maize, sorghum, and millet crops. The yields from such crops will not be as heavy as were anticipated, and it is advisable to supplement them by sowing other crops suitable for this season of the year.

*Barleys.*—These can be sown largely during this month at intervals, to ensure a rotation of green winter fodder. The Skinless and Cape varieties are the best. They require a soil in good condition, with a fair amount of available plant food near the surface.

*Ryes.*—These can be sown to advantage upon poorer soils than the barleys. The Black Winter and Emerald are suitable varieties, and produce a fair amount of green fodder throughout the winter. Successive sowings are advisable.

*Wheat.*—If some of the earlier varieties were sown this month they would provide excellent green fodder throughout the winter. If the later long-season varieties were sown towards the end of the month they would produce a fair amount of fodder to be grazed off judiciously throughout the early winter, and afterwards shut up for a crop of grain. Many good yields have been harvested from crops so treated.

*Oats.*—Some of the early varieties, such as Algerian and Red Rust Proof, if sown during this month would yield green fodder of excellent quality throughout the winter.

*Tares and Peas.*—May be sown towards the end of the month, alone or in conjunction with the foregoing cereals. When so mixed the fodder value of the resultant crop is much increased.

*Rape.*—Should be sown largely upon well-prepared land. It is preferable to sow it in drills about 2 feet apart, to allow of cultivation. It yields heavily upon good soil, and is an excellent fodder, especially for ewes and lambs.

*Swede Turnips.*—Can be sown largely, they requiring the same preparation as for rape. Should be sown in drills 2 feet apart, and thinned to about 9 or 12 inches in the drills. They yield heavily, and possess the advantage of being easily stored for late winter use.

*Thousand Headed Kale.*—Should be sown in drills about 3 feet apart. As a fodder it is very similar to rape, but does not mature as quickly. It produces large quantities of fodder upon soil in good condition.

*Carrots.*—A sowing should be made upon deeply-worked soil. They are greatly relished by horses.

The late potato and other crops should be kept free from weeds, and thoroughly cultivated.

The land intended for the reception of lucerne should be attended to, and kept free from weeds. The ploughing for the main cereal crops should be pushed along, in order to be in readiness for the early sowings.

## RIVERINA DISTRICT.—FEBRUARY.

G. M. McKEOWN.

*Wheat for Hay.*—March and April will be found the best months for sowing wheat for hay in this and similar districts. The preparation of the land should therefore be commenced without delay. For early ploughing the rotary-disc plough will be found invaluable. The land should be ploughed as deep as the nature of the soil will admit, and thoroughly pulverised. Forty-five lb. of plump seed will be found ample under local conditions. The seed should be sown with the drill, and with it about 60 lb. per acre of No. 1 or No. 2 superphosphate. The cost of the fertiliser will not be more than 3s. 6d. per acre, and the yield will be found to be largely increased. The Berthoud and Australian Talavera are the best kinds, making hay of far better appearance than the purple straw varieties. The white wheats are also more palatable for stock. As soon as conditions will admit, the preparation of land for all grain crops should be commenced.

*Oats.*—Land should be got ready without delay, as seed should be sown in March. Not more than a bushel of seed per acre should be sown in dry districts, and manure should be used as recommended for wheat. Algerian and Dun will be found the best varieties for hay. For feeding off, Carter's Cluster and Tartarian will be found among the best kinds, as they get away quicker than those which are the best for hay, but they do not stand drought so well in the later stages of their growth.

*Rape.*—Prepare for sowing as early as possible, as seed should be sown after the first fair fall of rain. The soil should be brought into fine condition by means of harrowing and roling. The seed, being small, should be sown on a surface made as even as possible, and covered lightly. For broadcast seed the lever harrow will be the best covering implement. Two pounds of seed will sow an acre. Dwarf Essex is the best variety.

*Vegetables, &c.*—Swedes should be sown as soon as there is sufficient moisture. White turnips may also be sown in small quantities during the month. Sow cabbage and cauliflower in beds, for later transplantation, where shade and water can be applied. Pumpkins and melons should be cultivated, and watered where water is available. Stake and tie up tomato vines, keeping too luxuriant growth in check. Pick all fruit as it ripens.

# Orchard Notes.

W. J. ALLEN.

## FEBRUARY.

It will be well this month to keep a close watch over all kinds of trees, and wherever scale of any kind is found use every effort to destroy same either by fumigating or spraying, using any one of the many mixtures which have been found by previous experience to do the best work. For the destruction of San José scale on deciduous trees there is no better spray for this season of the year than the resin and soda wash, and for citrus-trees fumigation is the easiest means of ridding the trees of all scales, but wherever brown scale or white louse is found on the trees, it is best to increase by one-fourth the strength of the charge as given in the fumigating table which I prepared some time ago.

I would again warn growers who practice fumigation not to treat the trees on hot days, but to do the work on cool days—at night or in the early mornings and evenings. In measuring the size of the tree take the extreme height and width before referring to the table to ascertain the quantities of chemicals to use, and be sure not to add the cyanide to the mixture until after the sulphuric acid and water have been put in the bowl or generator, and the latter placed under the tent, then drop it in and close the tent immediately. Great care must also be exercised not to allow any of the sulphuric acid to come in contact with either the hands or clothing, as it will make the hands very sore, and if it touches the clothing or tents it will burn holes in them.

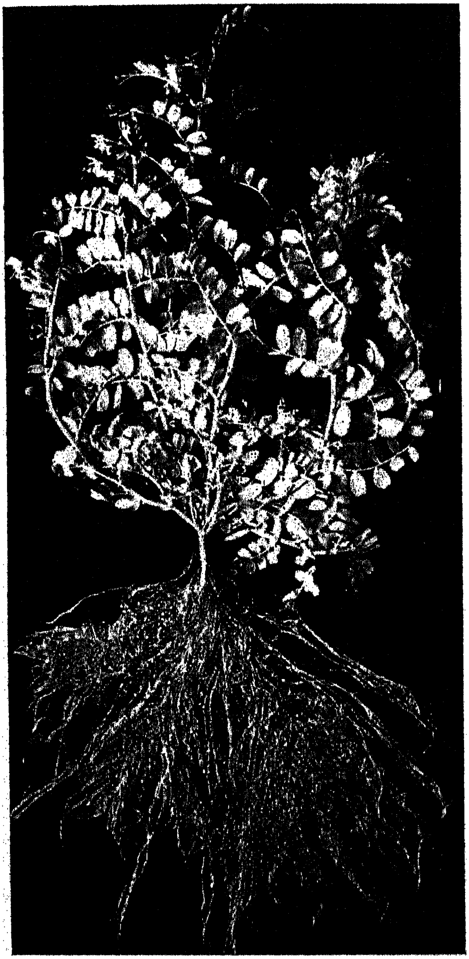
Keep the cultivator at work this month, and in this way keep down all weeds, as also the land in a fine state of tilth.

The early part of the present month is the best time to bud to better varieties all poor and worthless varieties of fruit-trees found growing in the orchard. Do not allow another unprofitable tree to remain there another year. Be sure that the buds used are taken from trees which have borne the very best quality of fruit, and do not forget that in the case of peaches the good canning varieties always find a ready sale at good prices.

Continue to fight the codlin moth by picking up and destroying all fruit found underneath the trees and found to be infested with the moth, and give regular attention to the bandages.

In districts where irrigation is practised deciduous trees will require their last watering, but grapes intended for raisin-making should not have water applied immediately before picking, as it delays the ripening, and is likely to make them more watery, and, as a consequence, they take longer in drying, and the chances are that the quality of the dried product will not be so good. The last watering of a vineyard should not take place later than the first of this month.

The drying of peaches, sultanas, and raisins will occupy the attention of growers this month, directions for the various processes being obtainable from the Department of Agriculture on application. Arrangements should be made towards the end of the month for sowing leguminous crops such as are required for green manuring, and as the fall and winter are the only seasons when such crops can be grown among the trees without robbing them of moisture, it is best to sow only such varieties as will make a fair growth during the cooler and cold months. Such crops as crimson clover, tares, &c., are depended on to furnish nitrogen and organic matter to keep the soil in a high state of fertility.



From a photograph of a Tares Plant grown at the Wagga Orchard.

At the Wagga, Bathurst, and Richmond orchards last year we had many acres of tares in among the trees, and wherever these were sown early they made good growth, and the fruit-trees are looking better in consequence. The accompanying illustration shows the plant and the root system, from which it will be seen that the roots are the largest part of the plant. To secure a good crop it is imperative that they should be sown as early as possible in March, so that the plant will make a good growth before the cold weather sets in, and so far as our experience has gone the tares have proved one of the best plants to grow for green manuring.

## ANALYSIS OF FIELD PEAS AND TARES, OR VETCHES, USED FOR GREEN MANURE IN THE ORCHARD.

AT THE instance of Mr. Caleb Gambling, of Thornleigh, the Chemist has made analyses of specimens of field peas and tares, or vetches, taken just as they were ready to be turned under for green manure in Mr. Gambling's orchard.

### *Field Peas.*

| | | |
|---|---|---|
| Water | 88·58 | per cent. |
| * Organic matter | 9·97 | ,, |
| Ash | 1·45 | ,, |
| | 100·00 | |

* Containing nitrogen = ammonia ·55 per cent.

Percentage composition of ash:

| | | | |
|---|---|---|---|
| Lime (C.O) | = | 10·62 | per cent. |
| Potash ($K_2O$) | = | 33·58 | ,, |
| Phosphoric Acid ($P_2O_5$) | = | 8·56 | ,, |
| Undetermined mineral matter | = | 47·24 | ,, |
| | | 100·00 | |

Calculated to whole plant:

| | | | |
|---|---|---|---|
| Water | = | 88·58 | per cent. |
| * Organic matter | = | 9·97 | ,, |
| Lime (C.O) | = | ·154 | ,, |
| Potash ($K_2O$) | = | ·487 | ,, |
| Phosphoric Acid ($P_2O_5$) | = | ·124 | ,, |
| Undetermined mineral matter | = | ·685 | ,, |
| | | 100·00 | |

* Containing nitrogen = ammonia ·55 per cent.

Each ton of the plant will, therefore, contain—

12⅓ lb. nitrogen
2¾ lb. phosphoric acid
11 lb. potash
3½ lb. lime.

The manurial value of the above, calculated on the unit values taken as a basis, is about 9s. per ton—that is to say, every ton of the pea ploughed under provides the soil with fertilising ingredients which would otherwise cost 9s.

### *Tares.*

| | | |
|---|---|---|
| Moisture | 83·97 | per cent. |
| * Organic matter | 14·96 | ,, |
| Ash | 1·07 | ,, |
| | 100·00 | |

* Containing nitrogen = ammonia ·88 per cent.

Percentage composition of ash:

| | | |
|---|---|---|
| Potash | 20·00 | per cent. |
| Phosphoric acid | 10·65 | ,, |
| Undetermined mineral matter | 69·35 | ,, |
| | 100·00 | |

Calculated on the whole plant:

| | | |
|---|---|---|
| Moisture | 83·97 | per cent. |
| * Organic matter | 14·96 | ,, |
| Potash | ·21 | ,, |
| Phosphoric acid | ·11 | ,, |
| Undetermined mineral matter | ·75 | ,, |
| | 100·00 | |

* Containing nitrogen = ammonia ·88 per cent.

Each ton of the plant will, therefore, contain 2½ lb. phosphoric acid, 4¾ lb. potash, 16⅓ lb. nitrogen, and provides fertilising material worth 9s. 8d. per ton at current market values.

# Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

## DIRECTIONS FOR THE MONTH OF FEBRUARY.

### Vegetables.

THE heat, generally, throughout New South Wales is great during the month of February; and unless the season is favourable and rainfall good, the raising of vegetables necessitates a good deal of perseverance and skill. However, if only a few sorts can be produced they are likely to be very welcome, and well worth the trouble taken to raise them.

Do not be afraid to pile up a thick mulch between the rows of vegetables, for on all farms there should be a plentiful supply of cow and horse dung available. But in addition to the mulch, it will be found almost absolutely necessary in the dry portions of the State to use water; and if it is not forthcoming, vegetables are not likely to grow.

About the coast, where the rainfall has been good, vegetables can be grown in abundance, and seed-sowing and planting can be carried on with every prospect of success.

In order to raise a sufficient supply of vegetables for transplanting later on, a good many different kinds of seed must be sown, and some trouble should be taken to make suitable seed-beds or to prepare boxes or seed-pans in which to sow the seeds. Some stuff for shading will be necessary. On the coast, tea-tree brush is about as useful a thing as could be obtained.

*French Beans.*—These may be sown during the month as largely as may be required. The best kind for general purposes is that known as Canadian Wonder. The Butter beans are good, and deserve a trial.

*Beet, Red.*—Sow a little seed in rows. Select rich ground, such as had been heavily manured for some previous crop. Before sowing the seed make a shallow drill—say about an inch or so deep. If the soil has been made quite fine a drill can be made with the forefinger. Drop the seed in the bottom of the drill, and if the soil is dry, water well before covering up, so as to give the seed a thorough soaking, and then cover over with fine soil, and press it down with the back of the spade. Always use a line to mark out the rows. A thick piece of string will serve the purpose well, and will last for a long time if taken care of. Plants that are growing should be thinned to about 9 inches or even to 12 inches apart in the rows. If the young beets that are thinned out are lifted with a little care they may be planted out if required.

*Beet, Silver or Spinach,* is an excellent vegetable to grow. Sow a little seed in rows, and afterwards thin out the seedlings when they have attained a height of about 2 or 3 inches. It may, perhaps, be more convenient to sow in a seed-bed and afterwards transplant in much the same manner as is adopted for cabbages, &c. The soil for this plant should be heavily manured with well-rotted, rich manure, for the leaves, and not the root, is the part used as a vegetable. The rows in the permanent bed should be about 2 feet apart, and the plants should stand about 2 feet or so distant from one another.

*Borecole or Kale* is best suited for the cool parts of the State. It belongs to the Brassica or cabbage family. The seed should be sown in seed-beds or boxes, and the seedlings afterwards transplanted. The soil should be made rich with well-rotted stable manure. Plant in rows 2 feet apart each way.

*Broccoli* resembles the cauliflower, and might easily be mistaken for it; in point of fact, it is a variety which takes longer to arrive at maturity, and there are other differences which are apparent to one used to growing vegetables. Seed to a small extent may be sown in a box or seed-bed.

*Brussels Sprouts.*—This is another and excellent variety of the cabbage, but differs in a most marked degree from that vegetable. The stem grows to a considerable height, and bears numbers of miniature cabbages. It is very suitable for cool districts and should be grown wherever it will thrive, for it is one of the best of vegetables, and can be grown as easily as an ordinary cabbage. Seed should be sown in a box or seed-bed, and every care should be taken in watering and shading sufficiently. When the plants are large enough they should be moved to well dug up but not too heavily manured ground that has been prepared for them. The growth should not be too rank, and the plants must not be forced, or else the young sprouts will not form well. If the ground is naturally rich it may, perhaps, be as well not to apply manure. However, if they do not thrive, manure can easily be applied in a liquid form. Plant in rows about 2 feet 6 inches apart. The plants to stand about 2 feet from each other in the rows.

*Cabbage.*—Sow seed in as great a quantity as may be needed in a seed-bed. Sow thinly in little rows, about 2 inches apart. A few plants may be set out in well-manured ground, from time to time, in order to keep up a succession.

*Carrot.*—Prepare some ground by digging deep and fine, and by well draining, but avoid applying manure unless absolutely necessary, and then take care that it is old and thoroughly rotten. The best way to manage is to use a bed, or part of a bed, which had been heavily manured for some other vegetable. If fresh manure is used the roots will, in all probability, become forked, and of bad shape. Sow the seed in drills, which should be made not deeper than half an inch. Cover over with fine soil, and firm down with the back of a spade. The seed is covered with little hooks, and care should be taken that it be well separated before sowing. The drills should be from 1 foot to 18 inches apart. The seed will take a good while to come up, and as the plants are exceedingly small at first the weeds should be looked to as often as possible.

*Cauliflower.*—Seed of this favourite vegetable may be sown largely during the month in a seed-bed, box, or pot, in the same way that cabbage and all others of the same family are sown. The seedlings, when large enough to move, will be improved by being planted out or "pricked out" in a small bed about 4 inches apart, where they can develop into good, strong, young plants for transplanting. The distance apart the plants should stand will depend on the richness of the soil. The better the soil the wider apart the cauliflowers should be planted. The distance may vary from about 2 feet or 2 feet 6 inches to 3 feet. At the same time, it should be kept in mind that although the soil may be poor, and but little manure has been dug into it, the plants can be fed by liquid manure, and made to grow to a very large size. In a few words, the distance at which plants should stand from one another will depend, in a great measure, on the quantity and quality of plant-food available.

*Celery.*—Sow a pinch of seed in a box or pot. When the plants come up, and are large enough to shift, prick them out in a small bed, where they can grow strong and hardy.

*Endive* is a good substitute for lettuce. A little seed may be sown during the month.

*Turnip, white.*—Seed may be sown in drills, in well-manured ground. When the plants come up, thin out well.

*Turnip, Swede.*—Sow as largely as necessary, as above.

*Potato.*—An effort should be made to raise a good supply of this useful vegetable. The soil should be well drained, well worked, and heavily manured with the droppings of farm animals. For seed, medium-sized whole potatoes are to be preferred to large ones cut into sets. The rows had better be wide apart, say 3 feet, and the sets put in about 1 foot apart in the rows. Plant about 5 or 6 inches deep. If it is necessary to use cut sets take care that the cut sides are dry before planting.

*Peas.*—If the weather is moist a few rows may be sown in the cool districts. The dwarf varieties are to be preferred for this season of the year.

*Radish.*—Sow a few rows occasionally during the month. Use well-rotted manure, and water occasionally if the weather is very dry.

## Flowers.

SOME important work may be done in the garden in getting land in order for planting in the early autumn, which is a good time for planting out all sorts of those plants which do not shed their leaves, and which are known as evergreens. It is a good time, also, for the striking of cuttings.

Amongst the evergreens is the Camellia, a beautiful flowering plant which succeeds admirably in New South Wales. There are many varieties of the Camellia, some of but indifferent quality and others of great merit. In good time a list of the best varieties to plant will be given. The main thing now is to get to work and make everything ready for planting.

Chrysanthemums and Dahlias will require a good deal of looking after should the weather be dry during the month. The former will soon be showing their flower-buds, and as they appear a great many of them should be removed, and the remaining buds will give better flowers. If extra fine show flowers are required, most of the flower-buds should be removed.

Dahlias which have produced flowers, and appear to be at rest, should be cut back, and the plants should be well watered and supplied with liquid manure occasionally. A fresh crop of flowers will soon appear.

Various kinds of spring-flowering bulbs may be planted, or next month will be perhaps the best time.

## OPENINGS FOR PRESERVED FRUIT.

THE Government of the United States have received from Consul-General Mason a report on the consumption and demand for fresh and preserved fruits in Germany.

American visitors to Germany have been, until quite recently, accustomed to note with some surprise how small a part fresh fruits and certain vegetable luxuries like celery, artichokes, melons, and egg-plant have contributed to the daily food of a great majority of even the wealthier class of people. Even at the principal hotels fresh fruits have been, and indeed are still, if not a rare luxury, at least a very costly one. The reasons usually ascribed for this general fact are that the climate and soil of Germany are not adapted, like that of France and Italy, to the culture of many kinds of fruits. The common blue plum, pears, and cherries grow naturally and well, but apples, peaches, melons, and apricots of native origin are generally of second-rate quality and relatively dear in price.

During the entire year ended April 1st, 1901, Berlin received from Italy alone 50 car-loads of cherries, 357 car-loads of table grapes, 245 car-loads of small summer fruits, 48 car-loads of winter apples, and 100 car-loads of vegetables. A comparison of these figures with those of the year following—April 1st, 1901, to March 30th, 1902—shows the surprising fact that in one year, despite business depression and generally diminished personal incomes, the import of Italian fresh fruits to Berlin alone rose to 100 car-loads of cherries, 600 car-loads of grapes, 375 car-loads of berries and small summer fruits, 150 car-loads of winter apples, and 120 car-loads of garden vegetables. The fruit stores of Berlin have doubled in number, and greatly increased their capacity and business during the past two years. Prices of fresh fruits, both at stores and on the markets, have declined as the supply has increased. Among the new institutions of the city are several so-called "reform cafés," in which fresh and canned fruits, jellies, &c., are served "in the American way," as a tempting substitute for the drinks and forms of food ordinarily provided at such establishments. Until within recent years, fresh fruits, when eaten at most German tables, were served as dessert—rarely or never at breakfast, the first meal of the day. Now many leading physicians prescribe fruits at breakfast, and the spread of this so-called American practice is one of the main reasons for the general and largely-increased importation and consumption which have become so noticeable.

Along with this has come a vastly-increased use of canned, dried, and otherwise preserved fruits, of which the imported supply comes in steadily-increasing volume from the United States. Within the past year these goods have been put on sale in immense quantities by the two leading department stores of Berlin, which, by means of special direct importations, have been able to offer canned peaches, apricots, pears, and cherries, and dried prunes, evaporated apples, &c., from the Pacific and other American States at prices so far below those charged for the same fruits by retail grocers as to open these imported luxuries to a large class of working poople with small incomes, to whom they were previously a forbidden—because a too costly—luxury.

There is hardly any reasonable limit to which the dried and preserved fruit export trade to Germany may not be in time developed, provided the business is conducted skilfully, with intelligent enterprise, and in good faith. The one exclusively American preserved-fruit store in Berlin has trebled its business during the past year, and is now contemplating removal to larger and more costly quarters in the principal retail thoroughfare. Grocers and provision dealers in all quarters of the city display boxes of California dried pears, apricots, prunes, apples, and peaches in their show windows as their most attractive advertisement. Most of these goods are fairly well graded and satisfactory, but there is more or less complaint about evaporated apples, which in many cases are not sufficiently dried, and being left too moist, become mouldy and depreciate rapidly in the humid climate of Germany.

The evaporated apple industry should by this time have reached a stage where account may be taken of the market for which the product is intended, and special treatment provided as climate and circumstances may require. So, too, in packing, the inner contents of a box of dried pears or apricots should be reasonably within the same grade of quality as the selected pieces which are so temptingly ranged along the top and bottom, otherwise the German retailer will feel that he has been cheated by a trick in which the best of a purchased commodity has been upon the outside.

One cannot help wondering when New South Wales will have a share in the splendid markets that are being constantly opened up for preserved fruits. In point of quality it would be almost impossible to excel our raisins, sultanas, prunes, and apricots, and there is right in our midst a local demand for such produce sufficiently great to help the industry to develop on lines of sufficient magnitude to enter the export trade.

## THINNING TOMATOES TO INCREASE SIZE OF FRUIT.

AT the Arkansas Agricultural Experiment Station experiments have been conducted to determine the effects of systematic thinning of tomato crops on the size of the fruit.

In cultivating the plants under trial, all lateral branches below the first cluster of blossoms were pruned off with a sharp knife. The plants were tied to stakes, and the lot that were allowed to produce what fruit they would received no further attention than the necessary cultivation of the surrounding soil and occasional re-tying to the stakes as the plants grew. The plants were all sprayed occasionally with Bordeaux mixture, and while the leaves and stems were wet with spray were dusted with Paris green, mixed with four parts of flour or road dust. The thinned lot were given the same treatment, except that not more than three fruits were allowed to remain upon one cluster, and generally only two. The thinning was done as soon as the young tomatoes were half or three-fourths of an inch in diameter. The dead blossoms were removed as soon as possible to prevent deforming. Frequently the young tomatoes, when not more than one-fourth of an inch in diameter, would show an irregular or improper shape, and this was of considerable advantage in enabling the selection of only the best fruit to remain on the vines. The thinning was done with a sharp knife.

Deficient rainfall and excessively high temperature during the season affected the thinned plots less than those not thinned, since a majority of the fruit on the former had ripened very early.

The following table shows the results:—

| Name of variety. | Average number of fruits per vine. | Total weight of fruit per vine. | Average weight of single fruit. | Weight of largest single fruit. |
|---|---|---|---|---|
| | | *Fruit thinned.* | | |
| | | lb. | oz. | oz. |
| Favourite .. ... | 9·5 | 8·10 | 13·60 | 17·0 |
| Imperial ... ... ... | 10·0 | 8·50 | 13·60 | 15·5 |
| Mikado ... ... ... | 9·0 | 11·00 | 19·50 | 24·0 |
| Ponderosa ... ... | 10·0 | 13 00 | 20·80 | 23·0 |
| Stone ... ... ... | 10·0 | 7·25 | 11·60 | 15·0 |
| Average ... ... | 9·7 | 9·57 | 15·82 | 18·9 |
| | | *Fruit not thinned.* | | |
| Favourite ... ... | 23·0 | 9·75 | 6·70 | 12·5 |
| Imperial ... ... ... | 18·5 | 7·25 | 6·20 | 16·0 |
| Mikado ... ... ... | 26·5 | 12·50 | 7·50 | 19·0 |
| Ponderosa ... ... | 29·0 | 14·00 | 7·70 | 17·3 |
| Stone ... ... ... | 26·0 | 9·50 | 6·20 | 13·0 |
| Average ... ... | 24·6 | 10·60 | 6·86 | 15·56 |

These results are interesting, as showing what can be done in the way of producing large tomatoes. For commercial requirements—at any rate, so far as Sydney markets are concerned—enormous fruits are not so much required, nor nearly so profitable as an even grade of medium size, the buyer being influenced more by the weight of the case than anything else.

# Market Review.

14 January, 1903.

POULTRY, &c., received at the Government Cold Storage Depôt.

| Date. | Fowls. | Ducks. | Geese. | Turkeys. | Rabbits. | Hares. |
|---|---|---|---|---|---|---|
| 1902. | | | | | pairs. | |
| January ... ... | 6,266 | 1,677 | 197 | 372 | 576 | ......... |
| February ... ... | 12,593 | 3,416 | 326 | 297 | ......... | ........ |
| March ... ... | 17,228 | 2,087 | 324 | 846 | 6,502 | 80 |
| April ... ... | 25,011 | 4,916 | 257 | 186 | 9,751 | 896 |
| May ... ... | 22,605 | 2,382 | 42 | 440 | 36,828 | 1,800 |
| June ... ... | 9,754 | 971 | 26 | 288 | 32,756 | 17,848 |
| July ... ... | 3,484 | 35 | 4 | 74 | 18,060 | 17,064 |
| August ... ... | 1,068 | 5 | 5 | 53 | 7,522 | 20,484 |
| September ... ... | 337 | ......... | ......... | ......... | 310 | 6,084 |
| October ... ... | ......... | 45 | 41 | 65 | ......... | 192 |
| November ... ... | 116 | 709 | 36 | 90 | 672 | ......... |
| December ... ... | ......... | 1,306 | ......... | 181 | 148 | ......... |
| Totals... ... | 98,462 | 17,549 | 1,258 | 2,892 | 113,125 | 64,448 |

Besides the above, the following were received :—

| 1902. | | |
|---|---|---|
| January ... | 270 | packages butchers' sundries. |
| February ... | 296 | ,, ,, |
| March ... | 655 | ,, ,, |
| April ... | 225 | ,, ,, |
| May ... | 218 | ,, ,, |
| June ... | 187 | ,, ,, |
| July ... | 64 | ,, ,, |
| August ... | 23 | ,, ,, |
| September.. | 37 | ,, ,, |
| October ... | 21 | ,, ,, |
| November.. | 54 | ,, ,, |
| December... | 162 | ,, ,, |
| Total ... | 2,212 | ,, ,, |

| 1902. | | |
|---|---|---|
| September .. ... | 778 | cases eggs. |
| October ... ... | 1,217 | ,, ,, |
| November ... ... | 835 | ,, ,, |
| December ... ... | 219 | ,, ,, |
| Total ... ... | 3,049 | ,, ,, |

POULTRY, &c., delivered from the Government Cold Storage Depôt.

| Date. | Fowls. | Ducks. | Geese. | Turkeys. | Rabbits. | Hares. |
|---|---|---|---|---|---|---|
| 1902. | | | | | pairs. | |
| January ... .. | 9,548 | 1,166 | 183 | 170 | 1,566 | 96 |
| February ... ... | 12,921 | 1,075 | 563 | 517 | 348 | 300 |
| March ... ... | 11,833 | 2,018 | 390 | 630 | 3,709 | 136 |
| April ... ... | 10,645 | 2,192 | 332 | 213 | 4,896 | 122 |
| May ... ... | 22,944 | 3,172 | 89 | 479 | 8,679 | 972 |
| June ... ... | 5,383 | 459 | 28 | 226 | 15,699 | 5,248 |
| July ... ... | 7,296 | 3,684 | 54 | 303 | 57,510 | 18,288 |
| August ... .. | 2,407 | 3,152 | 5 | 27 | 14,280 | 21,404 |
| September ... .. | 2,099 | 316 | ......... | 56 | 10,282 | 26,088 |
| October ... ... | 12,442 | 50 | 6 | 16 | 641 | 2,156 |
| November ... ... | 132 | 556 | 49 | 231 | 24 | 892 |
| December ... ... | 184 | 1,504 | 2 | 206 | 996 | 348 |
| Totals... ... | 97,834 | 19,344 | 1,701 | 3,074 | 118,630 | 76,050 |

Besides the above, the following were delivered :—

| 1902. | | |
|---|---|---|
| January ... | 609 | packages butchers' sundries. |
| February... | 262 | ,, ,, |
| March ... | 667 | ,, ,, |
| April ... | 225 | ,, ,, |
| May ... | 234 | ,, ,, |
| June ... | 161 | ,, ,, |
| July ... | 215 | ,, ,, |
| August ... | 37 | ,, ,, |
| September | 48 | ,, ,, |
| October ... | 21 | ,, ,, |
| November.. | 40 | ,, ,, |
| December.. | 78 | ,, ,, |
| Totals .. | 2,597 | ,, ,, |

| 1902. | | |
|---|---|---|
| September ... ... | 125 | cases eggs. |
| October ... ... | ... | ,, ,, |
| November ... ... | 4 | ,, ,, |
| December ... ... | 180 | ,, ,, |
| Total ... .. | 309 | ,, ,, |

The total number of Poultry received at the Government Cold Storage Depôt for 12 months ending December 31, 1902, amounted to 120,161.

237,260 single rabbits, and 76,050 hares were prepared for export.

The appended table shows that the poultry treated at the Government Cold Stores in 1902 was far in excess of previous years :—

| | Fowls. | Ducks. | Geese. | Turkeys. | Totals. |
|---|---|---|---|---|---|
| 1898 ... ... ... ... | 9,411 | 5,916 | 522 | 904 | 16,753 |
| 1899 ... ... .. ... | 12,570 | 8,034 | 404 | 1,800 | 22,808 |
| 1900 ... ... ... .. | 23,056 | 15,378 | 1,316 | 4,755 | 44,505 |
| 1901 ... ... ... .. | 45,999 | 21,202 | 1,755 | 4,184 | 73,140 |
| 1902 ... ... ... ... | 98,462 | 17,549 | 1,258 | 2,892 | 120,161 |

From January 1 to December 31, 1902, the value of imports to the port of Sydney amounted to £21,249,702, of which the principal items were :—

| IMPORTS. | Total, January 1 to December 31, 1902, inclusive. | IMPORTS—*continued.* | Total, January 1 to December 31, 1902, inclusive. |
|---|---|---|---|
| | £ | | £ |
| Apparel and drapery ... | 4,087,970 | Oilmen's stores ... ... | 751,348 |
| Beer ... ... ... ... | 169,010 | Ores ... ... ... . | 104,251 |
| Boots and shoes ... ... | 278,963 | Paints and oils ... .. | 372,482 |
| Cement ... ... ... | 41,427 | Produce ... ... ... | 1,855,012 |
| Copra... ... ... ... | 214,749 | Skins and hides ... ... | 531,268 |
| Drugs and chemicals ... | 467,736 | Spirits ... ... ... | 371,316 |
| Earthenware, &c., ... ... | 215,970 | Stationery and books ... | 629,698 |
| Flour... ... ... ... | 79,070 | Sugar... ... ... ... | 731,180 |
| Furniture and upholstery... | 352,312 | Tallow .. ... ... | 28,783 |
| Galvanised iron ... ... | 242,731 | Tea ... ... ... ... | 262,864 |
| Gold (uncoined) ... ... | 2,186,142 | Timber ... ... ... | 395,566 |
| Hardware ... ... ... | 1,399,426 | Tobacco and cigars... .. | 301,929 |
| Iron and steel ... ... | 296,438 | Wheat ... ... ... | 197,897 |
| Jewellery ... ... ... | 315,843 | Wool... ... ... ... | 262,696 |
| Jute goods ... ... ... | 172,770 | Coin (gold) ... ... ... | 157,231 |
| Machinery ... ... ... | 626,784 | | |

The total value of the exports from the port of Sydney from January 1 to to December 31, 1902, amounted to £17,120,315, of which the principal items were :—

| Exports. | Total, January 1 to December 31, 1902, inclusive. | Exports. | Total, January 1 to December 31, 1902, inclusive. |
|---|---|---|---|
| | £ | | £ |
| Apparel and drapery ... | 442,459 | Meats ... ... ... | 515,562 |
| Butter ... ... ... | 152,082 | Oilmen's stores .. ... | 267,997 |
| Coal ... ... ... ... | 38,883 | Paints and oils ... .. | 258,405 |
| Coin (gold) ... ... ... | 2,686,643 | Produce ... ... ... | 342,269 |
| Copper ... ... ... | 275,659 | Silver and silver lead bullion ... ... ... | 429,608 |
| Copra... ... ... .. | 8,598 | Skins and hides ... ... | 928,411 |
| Drugs and chemicals ... | 200,656 | Stationery and books ... | 137,410 |
| Flour... ... ... ... | 191,741 | Sugar ... ... ... | 147,286 |
| Galvanised iron ... ... | 43,524 | Tallow ... ... ... | 243,254 |
| Gold (uncoined) ... .. | 469,638 | Tea ... ... ... ... | 96,336 |
| Hardware ... ... ... | 360,587 | Tin ... ... ... ... | 136,588 |
| Jute goods ... ... | 48,459 | Tobacco and cigars ... | 244,182 |
| Leather ... ... ... | 473,933 | Wheat ... ... ... | 452,395 |
| Live stock ... ... .. | 64,589 | Wool ... ... ... | 5,936,609 |
| Machinery ... ... ... | 231,066 | | |
| Manures ... ... ... | 72,609 | | |

The following are the current prices of some of the leading lines of produce :—

Wheat—ex wharf, 5s. 8d. to 5s. 8½d. per bushel.

Flour—City Roller, £11 10s. to £12 ; Manitoba, £12 10s. per ton.

Bran—1s. 5d. to 1s. 6d. per bushel.

Pollard—1s. 11d. to 2s. per bushel.

Oats—Tasmanian, 3s. 4d. to 3s. 11d. ; New Zealand seed, 3s. 4d. to 3s. 11d. ; Algerian, 3s. 7d. to 3s. 8d. per bushel.

Lucerne—Hunter River prime, new dry green, £4 5s. to £5 ; other qualities, £3 10s. per ton.

Maize—Prime River, 5s. to 5s. 3d. ; Argentine, 4s. 6d. to 4s. 9d. per bushel.

Straw—Derrick, Tasmanian, £2 10s. per ton.

Oaten Hay—Local prime, £7 10s. to £8 ; medium, £6 to £7 ; imported, £4 5s. to £7 per ton.

Chaff—Imported, £5 5s. to £6 5s. ; local, £5 5s. to £5 10s. per ton.

Potatoes—Northern Rivers, £5 to £8 per ton.

Butter—Pasteurised, 10½d. ; factory, 9½d. ; second grade, 8½d. to 9d. per lb.

Cheese—Local loaf, 5½d. to 6½d. ; prime large, 5½d. to 6d. ; special brands, 7d. per lb.

Bacon—Best factory makes, sides for flitches, 11½d. ; middles 1s. 0½d., to 1s. 2d. per lb.

Eggs—South, 1s. 3d. to 1s. 4d. ; North, 1s. 2d. to 1s. 3d. ; Suburban new laid hen eggs, 1s. 5d. to 1s. 6d. ; duck eggs. 1s. 4d. ; Adelaide, 1s. 2d. to 1s. 3d. per dozen.

Hams—Colonial, in cloth, 1s. 1d. ; light weights, 1s. 1d. to 1s. 2d. ; special brands, 1s. 1d. to 1s. 3d. per lb.

Poultry—River: hens, 3s. to 3s. 6d.; young roosters, 4s. 6d. to 6s.; guinea fowls, 4s. 6d.; English ducks, 4s. to 6s.; geese, 6s. to 8s.; turkeys, hens (prime), 8s. to 9s.; gobblers (prime), 16s. to 30s.; extra, 40s. per pair.

Honey—Prime extracted, 3¾d.; medium, 3¼d. to 3½d. per lb.

Beeswax—Scarce, 1s. to 1s. 1d. per lb.

Barley—New Zealand, 4s. 6d. to 5s.; Californian, 4s. 3d. to 4s. 4d. per bushel.

Onions—Globe, £5 to £5 10s.; Hunter River, £3 per ton.

Peas—Blue, 10s.; grey, 6s. 6d. per bushel.

*Fruit Market.*

Bananas—Good, 1s. 6d. to 3s. 6d. per bunch; 6s. to 10s. per case.

Lemons—Rough, 4s. to 5s.; good, 9s.; choice coloured, 10s. per gin-case; American, 9s. 6d. per box of 180; Italian, 9s. to 10s. per half-case.

Oranges—Local, 1s. to 20s. per case; Italian, 8s. to 9s. per box of 150.

Apples—Local, 2s. 6d. to 7s. per case.

Plums—2s. 6d. to 5s. 6d. per case.

Tomatoes—Local, 3s. to 4s. per half-case, 2s. to 2s. 6d. per quarter-case.

Nectarines—1s. 6d. to 5s.; prime, 4s. to 7s. per half-case.

Pears—Local, 2s. 6d. to 5s. per case.

Peaches—Small, 2s. to 2s. 6d.; good, 4s. per gin-case; prime, 4s. to 5s. per half-case; jam sorts, 2s. per gin-case; slipstones, 4s. to 5s. per half-case.

H. V. JACKSON,
Secretary, Board for Exports,
Sydney.

## RYE.

WITH its usual characteristics so prominent in point of hardiness and wealth of growth, rye is a most suitable crop for forage purposes. It may follow any crop in the rotation such as maize, potatoes, millet, rape, or field roots, and is recognised as a useful "cleaning" crop. It has a distinct liking for sandy land, the growth, however, is proportionate to the richness of the soil. Stiff clays and damp soils, rich in humus, are unsuited to its requirements. The seed is best sown in drills, 1½ to 2 bushels to the acre, at a depth of from 2 to 3 inches. The drill buries the seed to a uniform depth, causing more of it to germinate. Very little cultivation is needed after sowing excepting when it is necessary to conserve moisture. Rye as a pasture is a splendid forage for all kinds of stock, and especially in stimulating an abundant milk flow in dairy cattle before it reaches the jointing stage. Sheep may be grazed on it earlier than cattle with the view of grazing it short, and to prevent it pointing and becoming woody. It is good practice when rye is required for winter pasture to sow clover with it. This combination forms valuable food for pigs as well as other stock.—H.W.P.

# AGRICULTURAL SOCIETIES' SHOWS, 1903.

| Society. | Secretary. | Date. |
|---|---|---|
| Lismore Agricultural Society | T. M. Hewitt | Feb. 3, 4, 5 |
| Berry Agricultural Association | A. J. Colley | ,, 4, 5, 6, 7 |
| Alstonville Agricultural Society | Frank H. Bartlett | ,, 10, 11 |
| Moruya A. and P. Society | John Jeffery | ,, 11, 12 |
| Manning River (Taree) A. and H. Association | S. Whitbread | ,, 11, 12 |
| Nowra A. and H. Society | R. Lemming | ,, 11, 12 |
| Ulladulla A. and H. Association (Milton) | C. A. Cork | ,, 18, 19 |
| Pambula A., H., and P. Society | J. B. Wilkins | ,, 18, 19 |
| Candelo Agricultural Association | C. H. Brooks | ,, 25, 26 |
| Tumut Agricultural and Pastoral Association | Bland Clayton | ,, 25, 26 |
| Robertson Agricultural and Horticultural Society | R. G. Ferguson | ,, 26, 27 |
| Bega Agricultural, Pastoral, and Horticultural Society. | J. Underhill | Mar. 4, 5 |
| Braidwood P. and A. Society | G. F. Taylor | ,, 4, 5 |
| Tenterfield Intercolonial P. A. and M. Society | E. W. Hoskin | ,, 3, 4, 5 |
| Tenterfield Fair Days | ............ | ,, 6, 7 |
| Berrima District A., H., and I. Society | J. Yeo | ,, 5, 6, 7 |
| Bombala Exhibition Society | R. M. Cook | ,, 10, 11 |
| Campbelltown A., H., and I. Society | A. R. Payten | ,, 10, 11 |
| Central New England P. and A. Assoc. (Glen Innes) | Geo. A. Priest | ,, 10, 11, 12 |
| Quirindi District P., A., and H. Society | Geo. Naughton | ,, 11, 12 |
| Tumbarumba and Upper Murray P. and A. Society | J. J. McAlister | ,, 11, 12 |
| Port Macquarie and Hastings District A. and H. Society | J. Y. Butler | ,, 12, 13 |
| Goulburn A., P., and H. Society | J. J. Roberts | ,, 12, 13, 14 |
| Gundagai P., A., H., and I. Association | A. Elworthy | ,, 18, 19 |
| Blayney A. and P. Association | H. R. Woolley | ,, 18, 19 |
| Inverell P. and A. Society | T. P. Borthwick | ,, 18, 19, 20 |
| Armidale and New England P., A., and H. Association (Armidale) | W. H. Allingham | ,, 18, 19, 20 |
| Camden A., H., and I. Society | C. A. Thompson | ,, 18, 19, 20 |
| Crookwell A., P., and H. Society | C. T. Clifton | ,, 19, 20 |
| Newcastle and District A., H., and I. Association | M. A. Fraser | ,, 19, 20, 21 |
| Castle Hill and District A. and H. Association | R. H. Lalor | ,, 20, 21 |
| Liverpool Plains (Tamworth) A. and H. Association | J. R. Wood | ,, 24, 25 |
| Gulgong A. and P. Association | G. E. Hilton | ,, 25, 26 |
| Orange A. and P. Association | W. Tanner | ,, 25, 26, 27 |
| Macleay A., H., and I. Association | E. Weeks | ,, 25, 26, 27 |
| Walcha P. and A. Association | F. Townshend | ,, 31, April 1 |
| Cooma Pastoral and Agricultural Association | C. J. Walmsley | April 1, 2 |
| Mudgee Agricultural Society | Joseph M. Cox | ,, 1, 2, 3 |
| Royal Agricultural Society of N.S.W. (Sydney) | F. Webster | ,, 8 to 16 |
| Hunter River (West Maitland) A. and H. Association | W. C. Quinton | ,, 21 to 24 |
| Bathurst A., H., and P. Society | W. G. Thompson | ,, 22, 23, 24 |
| Dungog A. and H. Association | Chas. E. Grant | ,, 29, 30 |
| Richmond River (Casino) A., H., and P. Society | E. J. Robinson | ,, 29, 30, May 1 |
| Wellington P., A., and H. Association | A. E. Rotton | ,, 29, 30 May 1 |
| Upper Manning (Wingham) A. and H. Association | W. Dimond | May 6, 7 |
| Clarence P. and A. Society | Jas. C. Wilcox | ,, 6, 7 |
| Lower Clarence Agricultural Society (Maclean) | Geo. Davis | ,, 12, 13 |
| Yass P. and A. Association | W. Thomson | Sept. 10, 11 |
| Cootamundra A., P., H., and I. Association | T. Williams | ,, 16, 17 |
| Temora P., A., H., and I. Association | W. H. Tubman | ,, 29, 30 |

[2 plates.]

VOL. XIV. PART 3. MARCH, 1903.

*Agricultural Gazette of New South Wales.*

# Seed Wheat.

(Continued from page 169.)

BY N. A. COBB.

## II—continued.

### *Irregularity of Stand from Ungraded Seed.*

If the reader will turn to page 148 and examine the illustration there given of the difference in size of the plants that grow from large, small, and medium-sized seed, he will, I am sure, be struck by the contrasts. The plants from the small seeds are a large fraction of a foot shorter than those from large seeds. This is part of their general inferiority. If such plants derived from large and from small seeds were mixed together in a common crop, and this is precisely what occurs in the great majority of our wheat crops, it is very easy to see that the harvest operations would be more difficult and less successful than they would be if the crop was more uniform in height; for if the low-growing heads are to be reached with the stripper, then the tall plants must be taken at a disadvantage, because so much straw has to be taken with them; and if the stripper is worked for the high-growing heads, then some of the lowest are missed. If the reaper and binder is being used, there is still a difficulty, which does not cease until after the sheaves are put through the thresher. I am inclined to think that the difficulties and losses resulting from irregularity in the growth of a crop are under-estimated, and looked upon as unavoidable. The use of graded seed will tend to reduce irregular growth, and thus help to avoid these difficulties.

All this is quite separate from the fact of inferior yield from ungraded seed, and constitutes an additional argument for the use of graded seed.

### *Are Gigantic Grains Defective?*

I have sometimes heard it said that the very largest seeds are not the best to sow. Whether this is part and parcel of the belief sometimes expressed in the good qualities of small seeds, I cannot say. I have sometimes come across gigantic grains, whose size was due to a fungus disease, and this has led me to think that there might possibly be something in the idea that monstrously large seed—in the case of wheat, that is—might be of poor quality. In the present series of trials there is nothing to countenance this idea. So far as I can see, the larger the seed the larger the yield, though the advantage grows relatively less as we go up the scale of grades, and as the cost of securing sufficient of the larger grades increases with the increase in the size of the seed, the profitableness of using only the very largest seeds is thus diminished.

It should be borne in mind that the author gives room here to little opinion as to the absolute value of the crops raised from large seed. He has concerned himself mainly with the market value. It may be that the use of the very largest seed, and the consequent striving always after size, will lead to a lower absolute quality in the product. This is a matter that it would be very interesting to inquire into carefully, not only with regard to wheat, but also with regard to crops of every nature, the question being, "Does the constant striving after large size and fine appearance tend to bring us towards a limit beyond which there is an absolute loss of product, loss of quality, loss in absolute value"? This question is certainly one that may be asked with a show of reason, and one that it would be well to have answered, but is one that will give the wheat producer of the present very little trouble. He has his living to make, and the market value is his touchstone, no matter how absurd the basis of that value may be.

There are, so far as I can see, no circumstances in which it is advisable in this State to sow small seed-wheat on land suitable for wheat-growing if it is reasonably possible to secure large, plump seed. The most that can be said is that if we knew beforehand that the season was to be of a certain favourable character, the prospective loss of yield from the use of pinched and small seed would not be so great as it would otherwise be. As, however, we never know what the season is going to be, I fail to see how we can advise the use of small and shrivelled seed, even if it entailed under such favourable circumstances a gain instead of a loss, simply because we cannot predict the seasons. Are we to use small and pinched seed season after season on the off chance that if a good season comes along we shall not lose quite as much as usual? That is really the absurdity into which the argument about the good qualities of small seed seems to resolve itself.

*I take it for granted that a given piece of land will bear to the best advantage at one time only a certain number of plants, and that it should always be the object of the farmer to have the land bear that number of plants, and to have the plants as thrifty and productive as possible, and if these suppositions are true, I cannot see that it will be anything but a loss to supply these plants by sowing small, shrivelled, and, therefore, inferior seed.*

Those who defend the sowing of small seed have a stock argument in the saying that there are so many more grains in every bushel of small seed that the resultant crop will be just as good—some even go so far as to say better. The argument that a bushel of small seed contains more grains breaks down at a number of points. In the first place, the argument seems to assume that the cost of the seed is a factor of the highest importance in the question. This is not so. The cost of small and inferior seed, although it is less, is not very much less. The difference is too small to be any great argument against large seed. As before pointed out, there is some reason to suppose that the actual fodder value of a bushel of small grain is about as great as that of a bushel of large grain. This from experimental grounds. If we turn to market values, we find chick-wheat often quoted only a fraction lower than good milling wheat.

The argument for small seed, based on the extra number of seeds per bushel, is capable of reversal. Suppose we say that although the bushel of large wheat contains a smaller number of grains, still the grains are larger, and will produce better plants. As a bare statement, that is just as strong as the one of which it is a reversal.

It may be asked in respect to the assertion that the bushel of small seed produces more plants, if the object is to secure more plants, what is the objection to securing this number by the use of a larger amount of good seed, thus covering the ground with the necessary number of plants, which in this case will be of the very best character instead of the starvelings due to the use of small seed?

The grading of seed is almost wholly neglected by farmers in some of the newer of the great agricultural countries, and this very fact is one that is sometimes pointed out in defence of not grading the seed. I have heard it said, in substance, by a well-known teacher of agriculture—a man whose word is respectfully listened to by thousands of farmers—that there could not be much in using graded seed, or farmers would not so generally neglect the matter. Add to this that one may find, in almost any farmers' meeting of any size, advocates of small and pinched seed, and we have, indeed, a strange state of affairs. One might pertinently ask this teacher of agriculture how, if a practice is to be its own sufficient defence, any improvement is ever to take place, and inquire of the advocates of pinched seed why Dame Nature does not provide all her plants with pinched and puny seed, if they are so much better.

The truth is that, other things being equal, plump seed is much better than shrivelled seed, and that where the results obtained from shrivelled seed are better than those obtained from plump seed, the result is due to other factors than the quality of the seed. A farmer some day sows some badly-pinched seed and reaps from it a good crop, and, possibly, concludes that pinched seed is as good as any, either unaware or forgetting to note that the conditions have been such that almost anything would have grown well. He may even sow plump seed in the same season, and get a poorer harvest from it than from the shrivelled seed, and in this case feel highly fortified in his good opinion of pinched seed. The mistake he makes is in attributing his result to the one obvious difference of seed,

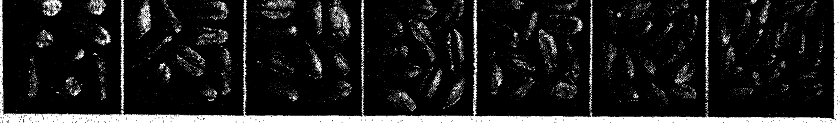


**Fig. 37.** **Fig. 38.** **Fig. 39.** **Fig. 40.** **Fig. 41.** **Fig. 42.** **Fig. 43.**

Figures showing the size of the grains belonging to each grade yielded by the sieves shown in Figures 23 to 28. The proper grade numbers are placed above each illustration.

entirely forgetting a score of other things that would help to account for the difference in result. Anyone who will take a sample of seed and grade it, as shown in the illustration above, and sow the same in drills side by side, can easily convince himself that the produce of a wheat plant depends in a marked degree upon the size of the seed from which it springs. The plants from grade 200, for example, will be much inferior to those from grade 325.

It may be asked if the yield from large plump seed is always greater than from small and shrivelled seed, how the contrary idea ever came to have any circulation whatever, but we have to remember that any paradoxical sounding statement may be easily put into circulation if it be gravely and plausibly made. Newspapers and other publications furnish abundant examples of this fact; and it is unnecessary to go into reasons for the fact.

It sometimes happens that a good crop is secured from poor seed. In such cases good seed would have given a still better crop, but this fact is overlooked. Sometimes these good crops from poor seed are alongside crops from good seed, and the latter are not so good as the former. Some people are cheerfully willing under such circumstances to make comparisons, regardless of the difference in soil, cultivation, rainfall, &c., and may come to the wrong conclusion that the poor seed is responsible for the superiority of the better crop.

If a wheat-grower reaps a paying crop from small seed he has in the course of ordinary farming no means of knowing how much better the crop would have been if the seed had been larger; and on the other hand, if he reaps only a poor crop from good large plump seed, he again has no means of knowing how much poorer the crop would have been if the seed had been poor and small. In the absence of this knowledge, he is not unlikely to come to a wrong conclusion as to the relative values of large plump and small shrivelled seed. There are two ways in which this baleful uncertainty may be dissipated—either through faith in the experience and advice of those who have studied the matter long and carefully, or by arriving at the truth through individual experiment. The second course is one that I would unhesitatingly recommend, if there exists the slightest doubt under the first head. The cost of the experiment is so trifling, and the result so convincing, that I venture to think that after three or four years of experiment, there will no longer be room for doubt as to the truth. Let any doubter who is inclined to the use of small or shrivelled seed, repeat each year a single experiment of the sort pictured in Fig. 27, p. 148, selecting the seed by hand, according to the sizes shown in Fig. 31, or anyone of the other similar figures in this report. The experiment need not cost him more than a few shillings each year. One hundred to two hundred seeds of each size is sufficient. At an entire cost of 30s. to 40s., spread over several years, he may acquire that faith in the good qualities of large plump grains as seed that will have a permanent value to him a hundredfold greater than the cost of the experiment.

On some soils naturally unsuitable to wheat the growth is too rank for the production of good crops of grain. Under such circumstances, the yield of grain from the stunted plants derived from shrivelled seed may be greater than that from larger and better seed; but this applies to grain alone, and not to the actual marketable yield of product. In such cases, even, it must not be forgotten that very thin sowing of good seed gives as good results as any plan if proper methods of culture are followed.

It may be that field trials of large and small seed sown side by side in the most careful manner will give results favouring the poor seed. Such puzzling instances may be seen among the tables of comparisons presented in the foregoing pages. These results only serve to show how little we know of the actual conditions of our soils. Instead of the extra yield from the poor seed being due to the seed, it is due to other factors in the experiment, as is most conclusively proved by the repetition of the experiment year after year, when it will be found that, in the vast majority of cases, the larger and plumper the seed, the better the yield.

These various considerations seem to me to account for whatever vogue has been secured by this tale of the good qualities of small and pinched seed.

It has been before remarked, but may be here repeated, that the trials upon which we base the present discussion were carried out on lands similar in character to large areas of this State where wheat is grown, and though one should be cautious in making such statements, I think it safe to say that the results here set down would have been similar if carried out on typical wheat land almost anywhere in the Riverina, or in those parts of the west where wheat is successfully grown. I feel all the more sure of this because the trials were continued through five years of widely varying character, varying from that of 1894–5, one of the best ever known in the Wagga district, to that of 1897–8, one of the worst ever experienced on the Wagga Farm, the drought being so bad that year that some of the gum trees on the Sister Hills died from dryness—an almost unprecedented occurrence. Again, the trials were carried out on newly cleared land; on land that had been cleared one, two, or three years; on "green" land; on fallowed land; on land in rotation. The land, too, though coming under the general descriptive terms, typical Riverina wheat land, was of a somewhat varying character, being in some of the trials composed of more decomposed granite than in others.

The results of the trials have left no room for doubt as to the superiority of large, plump seed under all these conditions. If the small and shrivelled seed have, in a few instances, yielded more than the larger seed, it has always been evident that it would be the height of folly to attribute the fact to the small or shrivelled character of the seed. The superior yield of the small seed in these exceptional cases was due to unknown factors in the soil, and I have no doubt this would also account for most, if not all, of the alleged successes of small and shrivelled seed.

In making a comparison between the results of these trials and the arguments of the advocates of the use of tailings for seed it is necessary to keep the following various factors in mind:—

1. That the small seed used in these trials was from specially selected healthy plants, and was, therefore, of the best quality, and free from disease.
2. That the conditions of culture under which these trials were made were probably such as favour the small seeds more than the larger seeds.
3. That the trials were between equal numbers of seeds.
4. That every particle of the tailings here used was genuine seed—there was no chaff, diseased or split seed, or foreign matter.
5. That the trials were made with accurately graded seed five years in succession, under conditions representative of the bulk of our wheat areas.

Or, to put the matter from the other side,—

1. Ordinary tailings contain a considerable proportion, amounting sometimes to 50 per cent., of chaff, split grain, diseased grain, and worthless foreign matter.
2. That the conditions of ordinary culture would probably be proportionately less favourable to the small seeds.
3. That, apart from the chaff, &c., in ordinary tailings, there is present considerable diseased grain, owing to the fact that in any given sample there is a tendency during the cleaning for such diseased matter to collect among the smaller grades.

Finally, it should be borne constantly in mind that in making any comparison as to yield we should take into account not only the grain, but also the straw, and remember that the *quality* of the crops from large seed is always markedly superior, regardless of amount.

A brief examination of the figures given in the tables will guard the reader against the conclusion that the lower yield of the plants from small seed is due wholly to the fact that the small seeds produce a smaller number of plants.

It will be found that where the number of plants from small seed is, say, 85 per cent. of the number from large seed, the yield is only 70 per cent. Evidence of this sort is to be seen throughout the tables, and is a conclusive proof that plants from small seeds are smaller and less productive than plants from large seeds. This fact has an important bearing on the contention that in order to get good crops from small seed, it is only necessary to sow more of such seed per acre. It may be admitted that if it is unfortunately necessary to sow small seed, it is best to sow a large quantity in order to make up for its inferior quality; but it must be remembered that it is in no case possible to get from small seeds as good a quality of crop, whether of grain or straw, as from large plump seeds under the same circumstances.

### *Age of Seed Experiment.*

In vol. IX, at p. 186, the writer made the following statement as to the rate at which seed wheat deteriorates in quality through keeping from year to year:—

"These experiments arose from the fact that I could get no satisfactory evidence of the rate at which wheat deteriorates in value as seed. Opinion varies all the way from belief in the vitality of seed found in Egyptian mummies to doubt as to the value of seed grown year before last. As I have saved seed each year for some years, I determined the vitality of the samples by the row system. My seed having been kept in an uniform manner, was eminently suitable material for this experiment. Of course this year's work only constitutes a beginning. I may say, however, that the results of this season alone show that if seed-wheat be kept in a warm dry place, it deteriorates in seed value very little in five years. This suggests the feasibility of keeping good seed over from season to season, so as to have a supply on hand against a season when all the wheat, being ill-grown, is inferior for seed. The cost of storing and the interest on the value of the stored seed would be less than the additional value of extra good seed in a season when all other seed is inferior, at least within certain limits. I may adduce as an illustration of this, that it would have been advantageous if seed at Wagga, 1894–5, had been reserved for 1895-6-7. If in reply it be asked, 'Why not procure seed from another district?' My answer would be that I now have fairly satisfactory evidence that seed from another district is not likely to be advantageous on a well-conducted farm, unless, in addition to the seed being very well-grown, the district be also similar in soil and climate, and that these facts increase the difficulty and cost of getting such seed."

### *Conserving seed for future use.*

The relative advantages of conserving seed from extra good years, and of procuring it from a distance may be compared as follows. The cost of conserving includes:—

1. Vermin-proof receptacle (cost, interest on outlay, deterioration, insurance).
2. Interest and insurance on the conserved seed, and deterioration, if any.

The cost of securing from another district includes:—

1. Freight and hauling.
2. Extra on the price—*i.e.*, profit to the seller.
3. To which must be added risks difficult to enumerate or valuate.

As a vermin-proof bin to hold 250 bushels can be constructed for under £5, upon which the annual charges need not exceed 5s. for deterioration, repairs, insurance, and interest, and as the interest, insurance, and deterioration on 250 bushels of wheat produced on the spot, and valued at 2s. per bushel, need not exceed £1 per annum, it will be seen that the expenses on the storage side of the question are such as to compare favourably with those on the other side. Probably, in most cases, if the object was to provide against one bad season in four or five, the balance would be in favour of the system of conserving one's own seed. I should, however, hesitate to recommend this conservation of seed wheat to careless unobservant growers, though I think there would be money in it for the wide-awake wheat growers.

### *Cost and utility of Graded Seed.*

Apart from the advantage to be gained from the use of graded seed of uniform size, there is the advantage gained from the fact that uniform seed can be sown more evenly from the drill in case that method of sowing is adopted, as it undoubtedly should be.

No farmer should allow himself to forget that all the various items of cost in connection with grading and selecting seed are much reduced *by selecting from his crop, before it is harvested, certain good portions to be taken off specially for seed purposes.* Such portions should be allowed to ripen fully before cutting, and be kept separate, to be cleaned and graded for seed purposes. This precaution of setting aside some of the best parts of the standing crop for seed will reduce the cost of first-class seed by a large percentage, and the resulting seed will be better than could be obtained by any other method whatever. Considering its value, it is marvellous how often this precaution is neglected.

Where the elevator system is in use there are facilities for the preparation of seed-wheat at a minimum cost. The grading machines in use in the elevators are of large size, and their capacity, and the fact that they are run by experts, places their product beyond competition as to price. As to quality, however, there are some drawbacks, principally in the direction of the purity of the sample, there being a great risk that seed from the elevators will be mixed, and more or less diseased, from the fact that none of these machines are treated for fungus diseases—at least, so far as I know, and I have made particular inquiries.

Apart from these considerations, for which remedies may be applied, the use of elevators leads to improvement in the quality of seed-wheat, as anyone may observe in regions where elevators are in use. The smaller country elevators, where they are supplied with cleaning machines, do a considerable business in returning seed-wheat to farmers. The cleaner most in vogue in the United States appeared to me to be that of the Silver Creek Grain-cleaning Company, of Silver Creek, New York. These cleaners are, however, designed especially for rapid work on a large scale, the object being to meet the commercial demands of the elevator owners, and it cannot be claimed for them that they turn out a sample equal to the types with a slower action especially designed for seed grain. Nevertheless, in a region characterised by careless farming, the good effects of elevator seed are manifest.

We have been considering this question of the relative seed-values of large and small grains hitherto wholly from a narrow and strictly and directly utilitarian point of view. There is another and higher point of view that should not be lost sight of, and that is the effect on the wheat industry of the constant effort to secure larger crops through the use of graded seed. Small plants will not produce large seeds, at any rate in the same proportion as large plants, and from this it follows that the constant breeding from the progeny of large and hence healthy plants, that follows on the practice of grading, must be in the long run of great benefit. Though it may be too small to be worth the consideration of the grower, this benefit accumulating by minute and imperceptible increments must be the main foundation for the hope of improvement in the wheat plant. It is needless to point out that all improvements in the quality of the wheat plant—it hardly matters how small they are—will be of vast benefit to the human race as a whole. Leaders in agricultural progress should, and no doubt do, receive from this thought great stimulus, and working as they do on the borderland of economic science where they are shut off from a full appreciation of their efforts and where from the nature of the case they are sometimes grievously misunderstood, they occasionally stand in need of some stimulus of this kind.

## III.—The Grading of Seed-wheat.

As to the method that should be followed in improving an ordinary sample of wheat for seed purposes, opinions may well vary, there are so many methods that may be adopted. The grower may perform the operation himself, or employ a miller to do it for him ; and whether he does it himself or hires it done, there is a great variety of machines adapted to the purpose, all having their various applications and degrees of merit. The cost of labour, the distance from nearest flour mill, the price of wheat, and other factors enter into the problem, and render it impossible to suggest a course of action suitable to all cases. It may however be well to call attention to certain points that are of general application.

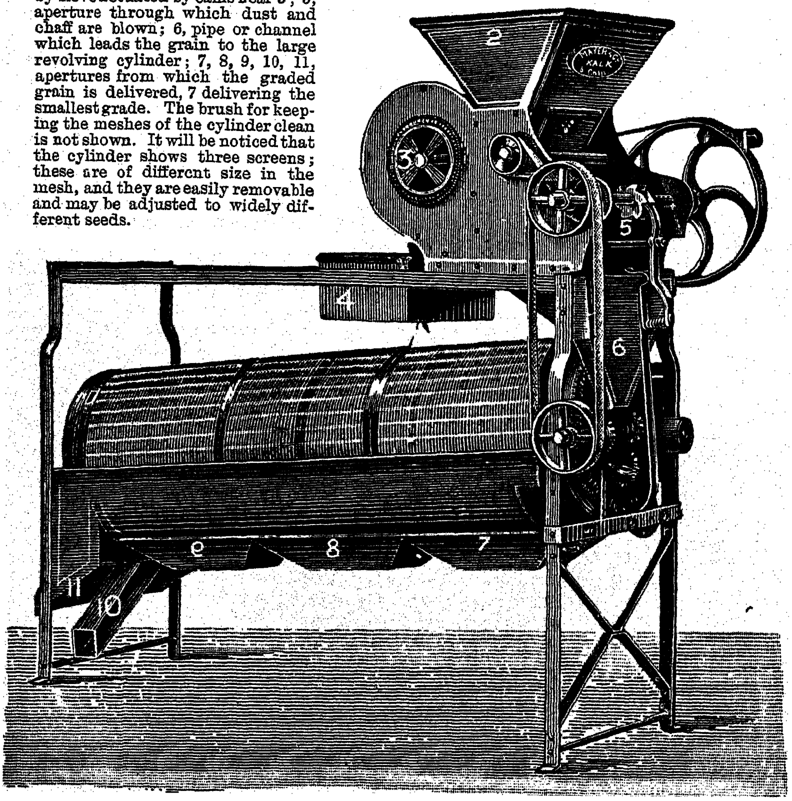


**Fig. 33.**—1, crank where hand-power is applied; 2, hopper; 3, fan; 4, box to receive coarse material removed by sieve actuated by cams near 5; 5, aperture through which dust and chaff are blown; 6, pipe or channel which leads the grain to the large revolving cylinder; 7, 8, 9, 10, 11, apertures from which the graded grain is delivered, 7 delivering the smallest grade. The brush for keeping the meshes of the cylinder clean is not shown. It will be noticed that the cylinder shows three screens; these are of different size in the mesh, and they are easily removable and may be adjusted to widely different seeds.

It is a well established principle that at a certain point in the cleaning of wheat, a change is desirable in the nature of the machinery employed. Up to the stage at which most of the wheat leaves the farmer's hands for the market it is necessary to use machines having both a blowing and a sifting action, as exemplified in the ordinary winnowing machine. There comes a point soon after this stage, however, beyond which any further use of air currents in the ordinary way is of little value; hence the operations must be largely confined to sieving. Here is where the New South Wales methods seem to me to be capable of much improvement. We are, in my opinion, too slow in adopting on our farms sifting machinery of the best type, and even fail to appreciate that which we already have available.

### *Grading Machinery.*

I recently had an opportunity to examine machinery of this class in operation, in all the leading grain-growing countries of the Northern Hemisphere, as well as an extended opportunity to examine the collection of competitive exhibits of this class at the Paris Exposition, an exhibit that was most completely representative of all the European countries, notably those of Middle Europe, where these machines have reached a high degree of perfection. As the result of thoroughgoing observation and trial that must have covered between forty and fifty different makes of grading machines, the impression left was a strong one that the machinery of this class in use in this State is very much below the best modern type, whether we take for comparison the machinery to be found on our wheat farms or that found in our flour mills, though in this latter respect the comparison is much more in our favour than in the former, from the fact that many of our mills are very well equipped.

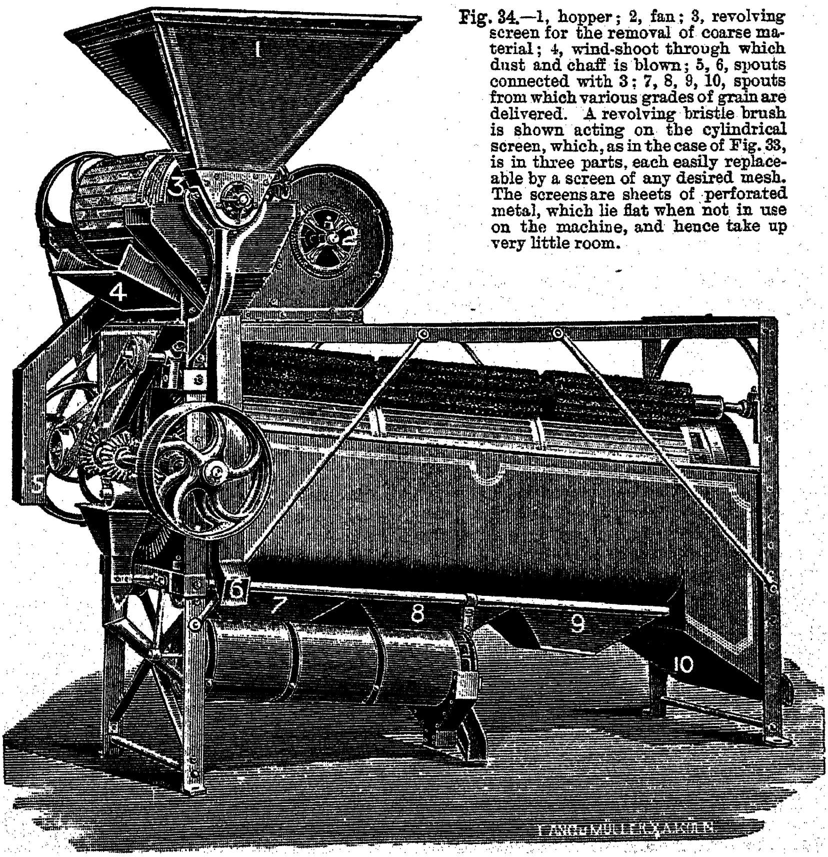


Fig. 34.—1, hopper; 2, fan; 3, revolving screen for the removal of coarse material; 4, wind-shoot through which dust and chaff is blown; 5, 6, spouts connected with 3; 7, 8, 9, 10, spouts from which various grades of grain are delivered. A revolving bristle brush is shown acting on the cylindrical screen, which, as in the case of Fig. 33, is in three parts, each easily replaceable by a screen of any desired mesh. The screens are sheets of perforated metal, which lie flat when not in use on the machine, and hence take up very little room.

I think our merchants would do well to make inquiry among the manufacturers of grading machinery in Hungaria, France, Germany, and America, and stick less closely to English models. If they will do this with an eye solely to merit and cost, I feel sure that they will be able to introduce a better grade of this class of machinery than has ever been sold here, and one that should command sales among farmers because of its efficiency and moderate price.

### *Sieves and their Meshes.*

A mechanical difficulty of considerable importance connected with wheat grading machinery is that of keeping the meshes clear. The grains tend to pass through as small a mesh as possible and this tendency causes them to bind in the meshes that are a fraction too small for them, and they thus accumulate in the meshes of the machine and clog its action. The best machines are provided with some mechanical means for meeting this difficulty without breaking the grain, and no machine can now-a-days be considered efficient without some such device.

The meshes of the screens now in use for grain sieves are made of woven wire, of metal rods, or of perforated sheet metal.

The wheat mesh that finds most favour is an elongated mesh made from sheet metal by means of perforating machines. The sieves made in this manner are very accurate and uniform, durable, and not likely to get out of order. They are easy to repair, and have a high degree of efficiency, and are withal as low in price as any other equally good form.

Woven wire meshes have the disadvantage that they are difficult to manufacture in a form sufficiently accurate for the work of grading, and if so made are liable to get out of order unless used with great care. As soon as the wire composing the meshes gets bent of broken, accurate work becomes impossible.

Sieves having meshes made by placing at stated distances metal rods or plates may be made very accurate in the mesh if the rods or plates are supplied with bearings at short distances so as to prevent the possibility of bending. Their disadvantages are the thickness of the mesh, if one may so speak of it—that is to say, the distance the grain has to go in passing through the mesh. If this distance is a sixteenth of an inch or more, there is greater liability that the meshes will clog in use. A second disadvantage is the amount of metal required by the method of construction, which leads to increased cost and makes the machine heavy to handle and harder to run.

The sieves made of thin perforated metal have the most accurate meshes and the thinnest meshes, and do the most accurate work. Since the perfecting of the modern perforating machines, and the adoption of perforated metal plates for a multitude of different purposes, the cost of this class of sieve has been reduced until it now ranks as one of the lowest in price. These perforation sieves are not liable to get out of order. This combination of accuracy, low price, and durability is a powerful one and has led in recent years to a very wide use of this class of sieve. The meshes are thin and as little likely to clog as any that can be constructed. These sieves have the disadvantage of a slightly slower action on account of the fact that the area occupied by the meshes is proportionally smaller than in screens made either of woven wire or metal rods.

Taking it all round, it is difficult to avoid the conclusion that at the present time the perforated metal sieve is the most satisfactory and accurate form for use on the farm.

There is another class of grader in wide use in flour mills that has sometimes been offered to the farming community as a farm implement, and may, therefore, deserve a little notice. It consists of a hollow cylinder, the inner surface of which is studded with pits of such a character as to receive only grain of a certain size. A further sorting mechanism separates these grains from the others, and thus the grading is accomplished. These machines are highly specialised and expensive. They are almost indispensable for certain work necessary in milling and malting, but have not, for the reasons stated, come much into use as a farmer's machine.

The grading accomplished by these machines is very perfect, and it is often by these and other very special machines that the grading will be done for the farmer if he takes his grain to a miller to be graded. These remarks are inserted here lest any novice in the subject should infer that grain can be graded only with the aid of the class of machine specially described in these pages.

### *Grading Machines of Various Types.*

In order to illustrate the principles laid down in the foregoing paragraphs, the adjacent illustrations of a grading machine made in Kalk, near Cologne, may be consulted. (Figs. 33 and 34.) It is of a type manufactured in several countries, and is selected because it is one of the best of its kind. It is a hand or power machine, of a size suitable for farmers, and may be had with or without the blower attachment. It is constructed entirely in metal, and is compact and solid. The weight is from 300 lb. to 600 lb., according to size.

The capacity is from 5 to 20 bushels per hour, according to size and manner of use; the machine, shown in Fig. 33, 6 feet long, 6 feet high, and 3 feet wide, has a capacity of 20 bushels per hour, and is advertised at about £25. The smallest size has a capacity of 2 to 5 bushels per hour, and costs £12. The smaller sizes are not always supplied with the revolving brushes for keeping the meshes clear of grains caught and held by friction. As before remarked, some such device as this for keeping the meshes clear is a great addition to this class of machine.

These hand machines are capable of cleaning or grading in a very effective manner from 3 to 6 bushels per hour, employing one man. This means, in this country, a cost of 2d. to 4d. per bushel for labour. At the rate of 1 bushel of seed-wheat per acre, this means the expenditure of from 2d. to 4d. per acre. This is a small expenditure in comparison with the increased yield that may be expected from the improved quality of the seed. In order for the return to repay the labour, it would only be necessary for the yield to be increased by one-twelfth to one-sixth of a bushel per acre of wheat, when the price of wheat was 2s. per bushel All increase of yield above this additional fraction of a peck per acre would be surplus on the labour expended.

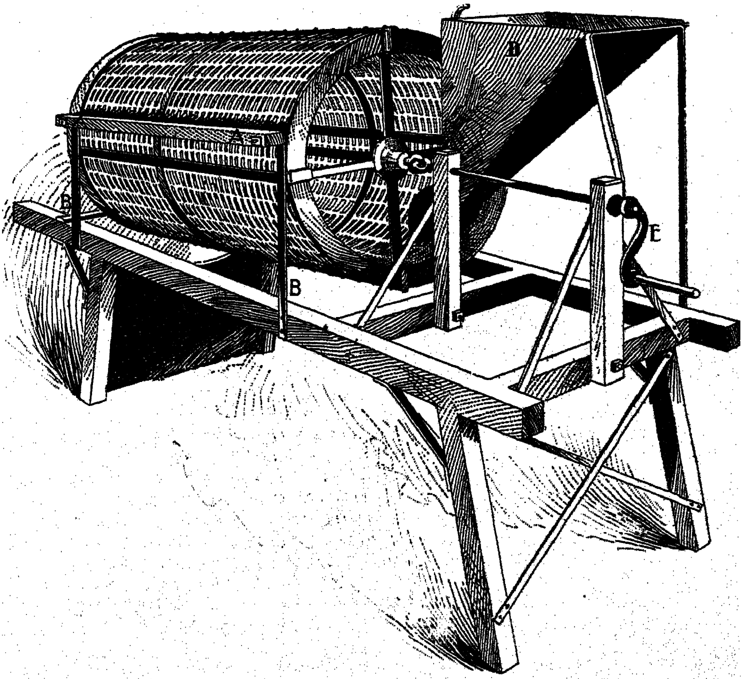


Fig. 35.—An Australian form of seed-wheat screen, or grader, suitable for use by farmers. The screen is a cylinder of perforated sheet metal, actuated by the crank, E. A brush, A A, is held against the screen by the springs, B B. The feed from the hopper, D, is regulated by the handle, C. The seed-wheat is caught at the further end of the screen, while the tailings fall on to the floor beneath. The capacity of the machine ranges up to 50 bushels per hour, but of course the quality of the work is not so good at 50 bushels per hour as at 20 bushels per hour; the slower the grading is done, the better it is done. The brush, A A, is an important factor in machines of this class. When, as in this case, only one size of mesh is supplied with the machine, a variety of grading can still be done by working the samples through several times. In this manner three quite distinct grades may be prepared with this machine, at the expense, however, of extra labour. For Australian wheat the mesh should not be less than 2·75 millimetres.

The prices of these machines of moderate capacity vary from £10 or less to £20, and they are so solidly constructed that, with good usage, they will easily last ten to twenty years on an ordinary farm. If we allow £1 or £2 per annum for interest and wear, according to the size of the machine, we have a cost of 1d. to 2d. per acre on a farm of 200 acres. This sum must be added to the actual cost of the labour of grading the grain in order to arrive at the total cost of grading.

It is a common experience of the farmers who take the lead in this direction, that such machines can be made to pay their way in fees from other farmers who require to have their seed graded, but have not the facilities for doing the work themselves. The machines can often be hired out at a remunerative rate.

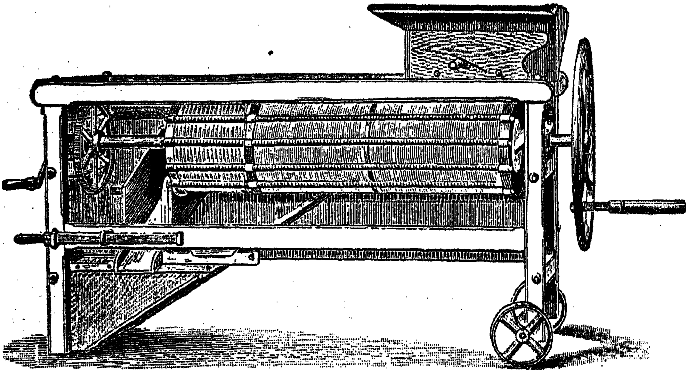


Fig. 36.—An English grader in which the meshes are made of wire in such a way as to be *adjustable in width*, without removal. The machine gives four grades of grain and does very good work. At the back near the top is the brush for keeping the meshes clear. This machine may be had with or without a fan.

The price at which wheat can be graded for seed by a miller varies according to the sample to be cleaned, the machinery at hand, and the skill with which it is used. Some foreign seeds are more difficult to remove than others; some samples clean more slowly than others, owing to the relatively larger proportion of small grain, &c., &c. While some samples can be cleaned for a penny a bushel so as to be fair seed, others will cost two to three times that amount, or even more. To this the miller's profit has to be added. Three pence per bushel would be an average price, 2d. would be low, and few samples would require 4d. These latter prices are the prices to the farmer, and include all costs, even rebagging. The prices assume that the miller has the facilities for the business and the inclination to go into it. If the miller considers grading for seed to be too much of an interference with the regular work of the mill, his price may be higher than those given above. The relative cost of cleaning a small quantity will always be greater than for a large quantity. Millers should always be required to exercise care sufficient to prevent mixing of seed. This is a matter that needs special attention. As a rule the modern machinery designed to handle large quantities of wheat is responsible for a large proportion of the mixing of varieties that is now-a-days so prevalent. The cleaning machinery in use by millers is no exception to the rule, but rather a striking example of it.

The farmer who raises his own seed has it in his power to reduce the cost of his seed-wheat very materially by selecting and harvesting separately the best portions of his crop for seed purposes.

Though we have paused here and there in these pages to examine the flimsy tissue of words that has done service as an argument or excuse for the use of small and shrivelled seed-wheat, it must not be forgotten that the main object, as stated at the outset, is to arrive by experiment at average figures that may be made the basis of definite rules for practice. With this object in view we endeavoured to tabulate and picture the best, worst, and average seed-wheat practice of the State. This furnished a clue as to the answer our best growers would give to the question, "How far is it best to go in improving an ordinary sample of wheat before using it for seed?" The nature of that answer has been clearly indicated, and it is such that if it is to be taken as a guide we must set out to improve our seed by much more care in sieving; but in doing this we naturally wish to know how far we may go before we pass the limits that will bring in a profit, and at what point the profit reaches a maximum. May we spend up to 1s. per bushel with no fear of incurring a loss, or may we go as far as 2s. per bushel with safety, or as far as 5s.? How far may we go with safety? That is a leading question, but there is another that to the ordinary grower is more fundamental, namely, "At what point does the profit reach a maximum?" For it is evident that as we approach closely to the limit of what we can afford to spend in sieving, the prospective profit begins to decrease, and at the limit ceases altogether.

### *How much can the Grower afford to spend in Grading Seed-wheat?*

As before remarked, we have recorded on an earlier page the answer given by our best wheat-growers to the question, "To what extent is it profitable to clean wheat for seed purposes?" Their answer, as represented in their practice, might, I think, reasonably have been expected to be a conservative and very cautious one—one that erred if at all on the side of small expenditure. Let us now seek an answer to this critical question among the tables of growth from large, medium, and small seed. Such a long series of carefully made trials may be trusted to throw considerable light upon this radical problem.

From the evidence given in the first section of this report it is evident that we must take one of the medium grades as representing the average quality of our seed-wheat. In Fig 20, showing the quality of our average seed wheat, it is the 2·50 grade that predominates, though the actual average lies between 2·50 and 2·75. Now this grade is about the same as that denominated "medium" in the various tests as to the relative value as seed of large, medium, and small grains. It follows that what we have to consider is the advantage, if any, of bringing our seed up to the average represented by the large seed used in the trials, namely, the 3·00 grade.

To the question, "Is it possible to bring our seed up to this grade?" we must answer at once, "Yes, easily." A perfectly grown sample of wheat of our commonest variety, grown on ordinary soil, without manure, but with good culture, actually averages better than 3·00. This is shown in our illustration, Fig. 14. A considerable number of the samples of seed-wheat obtained from farmers and reported in our table of the fifty best samples average better than 3·00. With the grading machines described in this report farmers can secure such seed from good average samples of wheat at a cost seldom, if ever, exceeding 6d. per bushel for the labour of sieving. Millers stand ready to grade wheat at a lower price still if they can have it in quantity sufficient to justify the use of their machinery for that purpose. This fact established, we wish to know what additional yield may be expected in return for this extra expenditure of a few pence per bushel on the seed. It is evident that what we have to ask from our tables is, what extra yield may be expected over that given by medium-sized seed, or 2·50 grade, if instead of that grade we sow 3·00 grade.

In the third set of trials the 3·00 grade excelled the 2·50 in about 90 per cent. of the cases, the extra yield of grain being 30 per cent.

In the second set of trials the 3·00 grade excelled in 69 per cent. of the trials, and the extra yield of grain was about 14 per cent. In this set of trials, however, the 3·00 was almost invariably compared with 2·75 instead of 2·50. This would no doubt account for the fact that the excess figures are lower than in the case of the third trial.

In the fourth trial, in two cases out of three, the 3·00 grade excelled the 2·50 grade in yield of grain by about 11 per cent.

In the first or preliminary trial the 3·00 grade excelled the lower grades in four cases out of five, the extra yield of grain being about 18 per cent. In this case the seed with which the 3·00 was compared was not in all instances smaller; in a number of the cases the seed with which it was compared was of about the same size but was shrivelled. It will be remembered that this first trial was made before the introduction of accurate grading.

To this excess of yield on the part of large seed we have to add the fact that there is also an extra yield of straw, and that the quality of the grain from the large seed is considerably better from a market point of view. Furthermore, so far as I am able to see, the nature of the trials was such as to probably favour the smaller grade, as explained elsewhere.

Leaving these latter points out of account, we have an average excess of grain, from the 3·00 grade, equal to about 20 per cent., taking the yield of the lower contestant, or 2·50 grade, as the basis of calculation. These figures represent the average of a succession of seasons, including a very good season, a very bad season, and an average season.

Notwithstanding the very definite results from this series of trials, I think it would be best, in basing practice upon them, to allow a good factor of safety, and we may easily allow this factor of safety to be 50 per cent. without bringing into question the strong advisability of using plump, graded seed of large size. This lands us at the conclusion that we may count with certainty on an extra crop value of 10 per cent. from the use of large, plump, graded seed. If a farmer has an average yield of 10 bushels per acre from the use of the average quality of seed now in use in this State, he may increase his yield from 11 to 12 bushels by the use of seed of the grade shown so frequently in this report under the figures 3·00,—a grade of seed that is within his reach at an expenditure of seldom more than 6d. per bushel for the labour of sieving, and with good practice, including the setting aside of the best portions of his crop for seed, often an expenditure of not more than 3d. per bushel for such labour. To this expense has to be added the interest, insurance, and depreciation connected with the grading machinery. This expense is discussed elsewhere.

## CONCLUSIONS.

1. Under field conditions, small and shrivelled wheat-grains do not appear to germinate so abundantly or so strongly as large and plump grains. This defect of small and shrivelled grains appears to be inherent in the grains themselves, and is independent of the season.

2. Under field conditions the plant-producing power of small and shrivelled grains is much below that of large and plump grains. This property is displayed independently of the season.

3. No matter what the nature of the season, the yield from large and plump seed is always greater than that from equal numbers of smaller and shrivelled seed, if the two crops be grown under similar conditions. This applies to the yield of both grain and straw.

4. Apart from the weight of the crop yielded, which is always in favour of the large seeds, the quality of the yield is decidedly better in the case of the plants grown from large and plump seeds, that is to say, the grain yielded from large seed is larger and plumper, and the weight per bushel is greater, and this difference is such as to decidedly affect the market value.

5. The superior yield from large and plump grain is sufficiently pronounced to justify the cost of first-class cleaning of ordinary wheat for seed purposes, and the amount so expended may, without loss to the grower, go in all cases as high as 10 per cent. of the value of his yield per acre. Allowing his average yield per acre to be ten bushels, and the average value of his wheat to be 2s. 6d. per bushel, and his average quantity of seed per acre to be one bushel, the grower may safely spend 2s. 6d. per bushel in grading his wheat for seed. It seems probable that the maximum of profit will result from that amount of grading that can be done with good machinery for about 6d. per bushel. While the yield per acre will be increased by all the additional grading and cleaning up to a cost of 2s. 6d. per bushel, the profit will not be in proportion, and may cease altogether at the grade of seed produced by the expenditure of 2s. 6d. per bushel.

This conclusion is drawn up on the basis of the yield of grain alone, for the reason that the basis of previous discussions on the subject have been the yield of grain. If the value of the straw be added to that of the grain then the amount of money that can profitably be spent in grading seed-wheat is somewhat increased. Grading for hay is just as profitable as for grain.

6. Allowing the liberal sum of £20 as the price of a seed grader suitable for farm use, and allowing the life of the machine to be twenty years, and allowing 10 per cent. for insurance, interest, and repairs, the regular cultivation of 50 acres of wheat will justify the purchase of such a grader.

7. If the grower does not care to encumber himself with grading machinery, the money that would be thus invested may be profitably spent in having his seed wheat prepared by any miller who has suitable machinery, the cost of such cleaning or preparation usually costing not more than 6d. per bushel at the mill, and very often much less.

8. Considering the healthy and exceptionally good condition of the tailings and smaller grades of seed used in these trials it seems impossible to avoid the conclusion that the inferiority here shown to exist in them is not so great as that actually existing in ordinary tailings, the use of which as seed has been advocated.

9. The foregoing conclusions apply to such land as that used for wheat in the Riverina district, and other important wheat areas of a similar character in various parts of Australia.

10. The advantages of large, plump, graded seed are that—

It is likely to be healthier seed, and therefore more likely to produce healthy plants.

It can be sown more evenly because of its uniform size.

There is a larger percentage of growth, and fewer failures.

The plants from such seeds are larger and thriftier and more resistant to disease, drought, and starvation.

The crops from such seed have a more even growth, and are more economical to harvest and thresh.

The yield per plant, both of grain and straw, is greater from such seed.

The crop of grain grown from such seed has a higher market value because—(*a*) It contains more large grains and fewer small grains. (*b*) It is plumper and better looking. (*c*) It weighs more per bushel.

The continuous use of such seed tends towards a general improvement in the quality of wheat.

The above list of conclusions are not the only deductions that may be made from the experiment tables. For example, the column of observations headed "Number of Plants that Grew" has been left as a bare statement of facts. It is obvious that a lengthy series of calculations can be made with the object of showing the relation of this column to the yield columns. From the general percentages of growth it would be possible to derive a factor which, when applied to the "Plants that Grew" column, would enable us to formulate a correction for the yield column that would tend to eliminate the accident element that exists in the yield column. As, however, through the very cordial co-operation of all the officers concerned, the experiments were under the most careful protection, and, furthermore, were blessed with good fortune in the field, there was very little accident of an obvious nature. The "soil mysteries" also were so evenly distributed as to give very little uneasiness. For these reasons it has not seemed to me worth while at present to make these corrections, it being rather an unnecessary refinement in this case.

It will be noted that as one goes up the scale of grades the increase in yield is a diminishing function. This fact might be presented in the form of a curve—a sort of "curve of profit" from grading—but I have not made the necessary calculations.

There is room, too, for deductions as to the effect of different seasons on the behaviour of various grades of seed, and for a number of other deductions, but for the present these are left to the ingenuity of the studious reader.

# Bunt Experiments of 1901.

W. FARRER.

THE experiments which were made for the purpose of freeing seed-wheat from the infection of bunt, and for preventing the crop from containing bunty heads, which were begun in 1899 and followed up in 1900, were continued in 1901, with the object mainly of seeing whether and to what extent the conclusions which I had formed from the former experiments were applicable under all the conditions I could command. I thought it necessary to make this series of check experiments before committing myself to making definite recommendations. And it turns out that it is well that this caution was exercised; for it appears that the behaviour of the same variety of wheat under the same treatment differs widely when the seed is sown at different times and in different soils. In addition to the experiments which will be shown in this paper, some others of an exploratory character were made; but as they were for the most part made in too loose a manner to allow an accurate description to be given of them, and as none of them yielded results which are worth following up, I shall leave them undescribed, and, in connection with them, shall confine myself to stating that treatment of infected grain with "eau celeste," made by adding ammonia to a 1 in 30 solution of bluestone, gave poor results.

I may state, what I have already pointed out, that owing to the circumstance that magpies destroy so many plants by pulling them up for the sake of the unexhausted grain when the young leaves first appear, it is impossible to make anything like accurate observations of the effect of the different fungicides on the germination of the seeds. Neither can this important subject be treated satisfactorily by tests made in the laboratory; for the poor "stand" of plants, which so often results from seed which has been treated with a fungicide, cannot be attributed entirely or probably so much to the seeds having been killed, as to the plantlet which issues from the seed failing, on account of the effect of the fungicide on its health and vitality, to reach the surface of the soil. Many of the young plants also, from the same cause, die after they have come out of the ground. The misses from these latter causes would not be shown by germination experiments in the laboratory; and experiments in the field, in which the drills are protected from birds, would be needed for accurate observations on this important point. The present season has shown that the condition, as regards moisture, of the soil is a factor of much importance in connection with this matter, and that conditions which are unfavourable to germination, such as are caused by drought, are fatal to a much larger percentage of treated seeds than of untreated.

There is one point, however, in connection with this subject which my experiments this season have brought out clearly. It is that the amount of injury which is done by treatment with bluestone depends very much on the variety treated. Mr. Allen tells me that the same is the case with fruits, and that some varieties of certain fruits are injured much more by spraying with certain fungicides than are others. A considerable number of new cross-bred varieties of wheat were planted this year in the wheat-experiment paddock at the Wagga Farm in blocks of about one-sixth of an acre, with the object of beginning the propagation of the best of them on a large scale. In all cases the seed had received the same treatment for bunt, and had been immersed for five minutes in a 1 to 50 solution of bluestone, which was in every case taken from the same bulk. The germination differed very greatly in these blocks, the estimated "stand" ranging from slightly less than 2 per cent. in the poorest block to about 70 per cent. in the best. At Lambrigg, no large blocks of the same variety were planted, but only single drills, mostly of unfixed cross-breds. The seed for these drills was subjected to exactly the same treatment as was made use of at Wagga Wagga. Many of these cross-breds are the progeny of the same mother-variety, and the progeny of several mothers have been planted. It is quite plain that in most cases the character of the stand depends on the parentage of the cross-bred. In those drills, in fact, which contain the progeny of any of the strains of White Lammas, the stand is distinctly poorer than is the case with the progeny of any other mother. So greatly do varieties appear to differ in the sensitiveness of their seed to treatment with bluestone (in a dry season, at any rate), that I think a list of varieties might be made, for which bluestone ought not to be used.

I shall now present the results of the year's experiments in a series of tables:

TABLE I.—Seeds treated with solutions of copper-sulphate (bluestone).

| Name of variety. | Date of planting. | Treatment. | Clean plants. | Bunty plants. | Per cent. bunty. |
|---|---|---|---|---|---|
| Steinwedel ... | 19 July | Infected and then soaked for 10 minutes in a (1 in 50) solution of bluestone. | 95 | 0 | 0 |
| Farmer's Friend.. | 10 ,, | Infected and then soaked for 5 minutes in a (1 in 50) solution of bluestone. | 126 | 0 | 0 |
| Purple Straw ... | 10 ,, | Infected and then soaked for 5 minutes in a (1 in 50) solution of bluestone. | 114 | 0 | 0 |
| Allora Spring ... | 10 ,, | Infected and then soaked for 5 minutes in a (1 in 50) solution of bluestone. | 96 | 2 | 2·04 |
| ,, ... | 10 ,, | Infected and then soaked for 5 minutes in a (1 in 30) solution of bluestone. | 160 | 4 | 2·44 |

It will be noticed that Allora Spring is the only variety which produced bunty plants after the seed had been treated with bluestone. Table III also shows that the same is the case with this variety alone after treatment with corrosive sublimate.

TABLE II.—Seeds treated with solution of Formalin.

| Variety of wheat. | Date of planting. | Treatment. | Resulting crop. | | |
|---|---|---|---|---|---|
| | | | Clean plants. | Bunty plants. | Per cent. of bunty. |
| | 1901. | | | | |
| 1. Farmer's Friend | 7 July | Infected, then soaked 5 minutes in solution of strength 1 oz. to 30 lb. water. | 37 | 0 | 0 |
| 2. Purple Straw | 7 ,, | Infected, then soaked 5 minutes in solution of strength 1 oz. to 30 lb. water. | 56 | 0 | 0 |
| 3. Allora Spring | 7 ,, | Infected, then soaked 5 minutes in solution of strength 1 oz. to 30 lb. water. | 28 | 0 | 0 |
| 4. Farmer's Friend | 7 ,, | Infected, then soaked 5 minutes in solution of strength 1 oz. to 30 lb. water, then washed in water. | 74 | 4 | 5·13 |
| 5. Purple Straw | 7 ,, | Infected, then soaked 5 minutes in solution of strength 1 oz. to 30 lb. water, then washed in water. | 34 | 1 | 2·86 |
| 6. Allora Spring | 7 ,, | Infected, then soaked 5 minutes in solution of strength 1 oz. to 30 lb. water, then washed in water. | 30 | 2 | 6·25 |
| 7. Farmer's Friend | 7 ,, | Infected, then soaked 4 minutes in solution of strength 1 oz. to 12 lb. water. | 41 | 0 | 0 |
| 8. Purple Straw | 7 ,, | Infected, then soaked 4 minutes in solution of strength 1 oz. to 12 lb. water. | 39 | 0 | 0 |
| 9. Allora Spring | 7 ,, | Infected, then soaked 4 minutes in solution of strength 1 oz. to 12 lb. water. | 18 | 0 | 0 |
| 10. Farmer's Friend | 7 ,, | Infected, then soaked 4 minutes in solution of strength 1 oz. to 12 lb. water, then washed in water. | 47 | 0 | 0 |
| 11. Purple Straw | 7 ,, | Infected, then soaked 4 minutes in solution of strength 1 oz. to 12 lb. water, then washed in water. | 44 | 1 | 2·22 |
| 12. Allora Spring | 7 ,, | Infected, then soaked 4 minutes in solution of strength 1 oz. to 12 lb. water, then washed in water. | 25 | 0 | 0 |
| 13. ,, ... | 6 Aug. | Infected and soaked 5 minutes in solution of strength 1 oz. to 14 lb. water, and then washed in water made slightly alkaline with ammonia. | 85 | 11 | 11·46 |
| 14. ,, ... | 6 ,, | Infected, then soaked 5 minutes in solution of strength 1 oz. to 14 lb. water, and then washed in water. | 48 | 49 | 50·52 |

With regard to the failure to kill the infection in the two last experiments, I may mention that I had, at the time, a bottle containing some formalin which had been left over from the previous year's experiments. This bottle had been simply corked up, and no special precautions taken for preventing the contained formaldehyde gas from escaping. An experiment with this formalin, which I have not recorded, showed that it had lost its strength; but this could not be detected by the smell. I think that this formalin may possibly have been used by mistake for these experiments.

TABLE III.—Seeds treated with a Solution of Corrosive Sublimate.

| Variety of wheat. | Date of planting. | Treatment. | Result. | | |
|---|---|---|---|---|---|
| | | | Clean plants. | Bunty plants. | Per cent. of bunty. |
| Farmers' Friend.. | 10 July. | Infected, then soaked 3 minutes in solution of strength 1 in 400. | 69 | 0 | 0 |
| Purple Straw ... | 10 ,, | Infected, then soaked 3 minutes in solution of strength 1 in 400. | 52 | 0 | 0 |
| Allora Spring ... | 10 ,, | Infected, then soaked 3 minutes in solution of strength 1 in 400. | 48 | 0 | 0 |
| Farmers' Friend.. | 10 ,, | Infected, then soaked 3 minutes in solution of strength 1 in 400, and then washed in water. | 72 | 0 | 0 |
| Purple Straw ... | 10 ,, | Infected, then soaked 3 minutes in solution of strength 1 in 400, and then washed in water. | 42 | 0 | 0 |
| Allora Spring ... | 10 ,, | Infected, then soaked 3 minutes in solution of strength 1 in 400, and then washed in water. | 38 | 0 | 0 |
| ,, ... | 2 Aug. | Infected, and afterwards soaked 3 minutes in solution of strength 1 in 400. | 76 | 1 | 1·3 |
| ,, ... | 2 ,, | Infected, and afterwards soaked 3 minutes in solution of strength 1 in 400, and then washed in water. | 97 | 1 | 1 |
| ,, ... | 2 ,, | Infected, and afterwards soaked 3 minutes in solution of strength 1 in 400, and then washed in water made slightly alkaline with ammonia. | 96 | 0 | 0 |
| ,, ... | 3 ,, | Infected, and afterwards soaked 3 minutes in solution of strength 1 in 400. | 55 | 0 | 0 |
| ,, ... | 3 ,, | Infected, and afterwards soaked 3 minutes in solution of strength 1 in 400, and then washed in water. | 95 | 1 | 1 |
| ,, .. | 3 ,, | Infected, and afterwards soaked 3 minutes in solution of strength 1 in 400, and then washed in water made slightly alkaline with ammonia. | 93 | 3 | 3·12 |

This table shows that, as far as doing its work of killing bunt spores effectively, corrosive sublimate is an excellent fungicide; but this substance is so poisonous and so undesirable to have on a farm that its use cannot be recommended if a less poisonous substance can be found, which does the work anything like as well. It will be observed, as was the case in previous experiments with bluestone, that washing the seed after treatment with the fungicide tends to diminish its effectiveness; also that, for some reason, this fungicide was like bluestone (v. Table I), in being less efficient when Allora Spring was the variety infected than was the case with the other varieties which were treated.

TABLE IV.—Results of infections made after treating with different fungicides and drying :—

| Variety of wheat. | Date of planting. | Treatment. | No of clean plants. | No. of bunty plants. | Per cent. of bunty. |
|---|---|---|---|---|---|
| Farmers' Friend.. | 10 July | Soaked five minutes in 1 in 50 solution of bluestone, and afterwards dried and infected. | 53 | 1 | 1·85 |
| Purple Straw ... | 10 „ | Soaked five minutes in 1 in 50 solution of bluestone, and afterwards dried and infected. | 59 | 0 | 0 |
| Allora Spring ... | 10 „ | Soaked five minutes in 1 in 50 solution of bluestone, and afterwards dried and infected. | 41 | 4 | 8·89 |
| Farmers' Friend.. | 10 „ | Soaked three minutes in 1 in 400 solution of corrosive sublimate; then dried and infected. | 36 | 6 | 14·28 |
| Purple Straw ... | 10 „ | Soaked three minutes in 1 in 400 solution of corrosive sublimate; then dried and infected. | 43 | 4 | 8·51 |
| Allora Spring ... | 10 „ | Soaked three minutes in 1 in 400 solution of corrosive sublimate; then dried and infected. | 21 | 6 | 22·22 |
| „ ... | 2 Aug. | Soaked five minutes in 1 in 30 solution of bluestone ; then dried and infected. | 69 | 17 | 19·77 |
| „ ... | 3 „ | Soaked five minutes in 1 in 30 solution of bluestone ; then dried and infected. | 61 | 15 | 19·74 |
| „ ... | 3 „ | Soaked three minutes in 1 in 400 solution of corrosive sublimate ; then dried and infected. | 18 | 38 | 67·86 |

The only conclusion which can be drawn from this table is that treatment with bluestone affords greater protection than corrosive sublimate against re-infection. This doubtless comes from the fact that the grain which had been treated with bluestone had a much thicker film of that substance on it ; but a serious discrepancy is that the stronger (1 in 30) solution of bluestone afforded so much less protection against re-infection to Allora Spring in the experiments of 2nd August and 3rd August than the weaker (1 in 50) did to the same variety in the experiment of 10th July. This I cannot account for, or for the inferior protection the same variety received from corrosive sublimate in the experiments of 3rd August, as compared with those of 10th July. It will be seen that in all the experiments, in which the seed was planted so late in August, there was more bunt in the resulting crop than was the case in corresponding experiments in which the plantings were made earlier. I suspect that this came from the seeds having germinated more quickly, and more nearly with the bunt-spores, after the weather had become warmer than was the case with plantings made in the winter.

TABLE V.—Results of simply infecting different varieties and planting at different times.

| Variety. | Hard or soft. | Date of planting. | Clean plants. | Bunty plants. | Per cent. of clean plants. | Per cent. of bunty plants. |
|---|---|---|---|---|---|---|
| Farmers' Friend ... ... ... | Soft ... | 21 June | 3 | 76 | 3·79 | 96·21 |
| ,, ... ... .. | ,, ... | 10 July | 11 | 20 | 35·48 | 64·52 |
| Allora Spring ... ... ... | ,, ... | 21 June | 9 | 236 | 3·67 | 96·33 |
| ,, ... ... ... | ,, ... | 10 July | 12 | 10 | 54·54 | 45·46 |
| ,, ... ... ... | ,, ... | 3 Aug. | 10 | 175 | 5·40 | 94·60 |
| Lambrigg White Lammas ... | ,, ... | 22 June | 5 | 75 | 6·25 | 93·75 |
| ,, ... | ,, ... | 4 July | 66 | 245 | 21·22 | 78·78 |
| Hurst's White Lammas ... ... | ,, ... | 22 June | 0 | 64 | 0 | 100·00 |
| Lambrigg White Essex ... ... | ,, . | 29 ,, | 6 | 69 | 8·00 | 92·00 |
| Australian Talavera ... ... | ,, ... | 5 July | 2 | 76 | 2·56 | 97·44 |
| Lambrigg Australian Talavera ... | ,, ... | 23 June | 6 | 72 | 7·69 | 92·31 |
| White Tuscan ... ... ... | ,, ... | 29 ,, | 2 | 90 | 2·17 | 97·83 |
| Nonpareil ... ... ... ... | ,, ... | 29 ,, | 8 | 78 | 9·30 | 90·70 |
| Brodie's Prolific ... ... ... | ,, ... | 21 ,, | 22 | 69 | 25·29 | 74·71 |
| Hudson's Early Purple Straw ... | ,, ... | 29 ,, | 28 | 16 | 63·62 | 36·38 |
| Purple Straw ... ... ... | ,, .. | 5 July | 11 | 70 | 13·58 | 86·42 |
| ,, ... ... ... | ,, ... | 10 ,, | 8 | 27 | 22·86 | 77·14 |
| Steinwedel... ... ... ... | ,, ... | 19 ,, | 33 | 52 | 38·82 | 61·18 |
| Outpost ... ... ... ... | ,, ... | 5 ,, | 4 | 79 | 4·82 | 95·18 |
| Dart's Imperial ... ... ... | ,, ... | 23 June | 6 | 72 | 7·69 | 92·31 |
| Cleveland ... ... ... ... | ? .. | 29 ,, | 2 | 83 | 2·35 | 97·65 |
| Tweed ... ... ... ... | ? ... | 29 ,, | 4 | 84 | 4·55 | 95·45 |
| Napier ... ... ... ... | ? ... | 22 ,, | 11 | 72 | 13·25 | 86·75 |
| Blount's Lambrigg ... ... | Hard ... | 29 ,, | 2 | 72 | 2·70 | 97·30 |
| Jonathan No. 1 ... ... ... | ,, ... | 21 ,, | 36 | 57 | 38·71 | 61·29 |
| ,, ... ... ... | ,, ... | 1 July | 162 | 139 | 53·82 | 46·18 |
| Lightloaf ... ... ... ... | ,, ... | 21 June | 13 | 73 | 15·12 | 84·88 |
| Hornblende ... ... ... | ,, .. | 19 ,, | 22 | 22 | 50·00 | 50·00 |
| ,, ... ... ... | ,, ... | 21 ,, | 15 | 54 | 21·74 | 78·26 |
| Power's Fife ... ... ... | ,, .. | 19 ,, | 15 | 51 | 22·73 | 77·27 |
| ,, ... ... ... | ,, ... | 5 July | 311 | 55 | 84·97 | 15·03 |
| Improved Fife ... ... ... | ,, ... | 19 June | 13 | 76 | 14·60 | 85·40 |
| Waniassa ... ... ... ... | ,, ... | 29 ,, | 24 | 68 | 26·09 | 73·91 |
| Punch ... ... ... ... | ,, ... | 29 ,, | 12 | 70 | 14·63 | 85·37 |
| Minnesota Blue Stem ... ... | ,, ... | 1 July | 249 | 75 | 76·85 | 23·15 |

RAINFALL at Lambrigg, 1901.

|  | Points. |  | Points. |  | Points. |  | Points. |
|---|---|---|---|---|---|---|---|
| 3 June ... | 1 | 9 July ... | 2 | 7 August ... | 7 | 21 August ... | 28 |
| 6 ,, ... | 51 | 10 ,, ... | 44 | 8 ,, ... | 5 | 23 ,, ... | 2 |
| 7 ,, ... | 59 | 16 ,, ... | 5 | 16 ,, ... | 45 | 25 ,, ... | 33 |
| 14 ,, ... | 6 | 25 ,, ... | 15 | 17 ,, ... | 6 | 26 ,, ... | 78 |
| 17 ,, ... | 11 |  |  | 18 ,, ... | 18 | 27 ,, ... | 9 |
| 18 ,, ... | 28 |  |  | 19 ,, ... | 20 | 28 ,, ... | 2 |
| 19 ,, ... | 1 |  |  | 20 ,, ... | 8 | 29 ,, ... | 1 |

It is very difficult to extract information from Table V, or to connect causes and effects in dealing with the facts presented in it. One conclusion that I think can be fairly drawn is that soft wheats take the infection of bunt more easily; or, at any rate, that more of them produce bunty heads when infected seed is sown than is the case with hard varieties; yet exceptions, or, as I am inclined to suspect, apparent exceptions to this rule occur in it. The data given in the table show that the average percentage of bunt-free plants amongst the soft wheats is 16·8, and in the hard 35·18. It will be noticed that in the case of the varieties Farmer's Friend, Purple Straw, and Allora Spring, the drills which were planted on July 10th gave a far higher percentage of bunt-free plants than did the plantings of the same varieties which were made on the other dates; and yet there seemed to be nothing to account for this circumstance in the conditions as regards moistness of the ground at this date (*vide* Table attached, showing the rainfall for the months of June, July, and August).

The most interesting departure from the apparent rule that when bunty seed is sown more plants produce bunty heads amongst soft wheats than hard, is the case of Hudson's Early Purple Straw, a drill of which only produced 36·38 per cent. of bunty plants. If in this case there has not been some special cause (*e.g.*, the infecting of the seed having been done imperfectly), it is important, because it shows that the quality of producing relatively few bunt-free plants when infected seed is sown is not necessarily denied to soft varieties. I shall make another trial of Hudson's Early Purple Straw and see whether in reality it possesses this point of superiority over the other soft varieties. Blount's Lambrigg again is an exception amongst the producers of hard grain, and the drill of it contained a very large proportion of bunty plants; but this variety, although its grain is hard, is not a producer of such strong flour as are the other hard varieties in our list; and as the late M. H. L. de Vilmorin in his classification of wheats has not placed Blount's Lambrigg with the strong-flour, hard varieties, but with such weak-flour and soft sorts as White Lammas, Purple Straw, and Steinwedel, its great liability to bunt is not to be wondered at.

The main cause of the great irregularity in the proportions of clean plants which this Table discloses has been, I am pretty sure, the circumstance that the samples of grain which were used for these experiments were not taken from large bulks of their respective varieties, but from small packets of seeds which were either produced by single plants, or by several plants, all of which were the progeny of a single plant. As no attention whatever was given to securing evenness of behaviour under exposure to the infection of bunt in fixing any of the varieties which were used for these experiments, it is to be expected that the different plants which produced these samples of seed, although they belonged to the same variety, would differ considerably in the resistance they offered to this parasite, and that they would transmit to their progeny their own respective degrees of liability to infection. I hope next year to place these tests on a more satisfactory basis. For this purpose at least twenty varieties will be selected and plantings of them from the same bulks made at different times and in different places. Care will be taken to have the planting of each series done on the same day and to select land which is as uniform as possible for each planting. By doing this it will be possible to see whether the relative resistance to infection remains fairly constant, even if, as is to be expected, the different sowings show different proportions of bunty plants.

The results of treatments of infected seed with different fungicides are now sufficiently numerous to justify the recommendation of some particular treatment, although each of the fungicides which have been tested seems to have some recommendations of its own and some drawbacks. It will be well, therefore, to discuss each treatment and to point out the objections to it and its recommendations before a preference is given to any one treatment.

(1.) *Bluestone (Copper Sulphate).* The trials of this substance have on the whole, so far as its action as a fungicide are concerned, been fairly satisfactory. It may not be quite so reliable as corrosive sublimate, but it is much less dangerous as a poison, is easily recognised, and is not likely to be mistaken for anything else. The great objection to bluestone is that it is apt to injure and even to kill the seed germs. The injury to the germs is seen in the weakening of the vitality of the plantlets which the seeds produce. I think it is quite possible that the damage is not usually done by the actual immersion and that with solutions of the strengths which are commonly in use, the length of the immersion, whether it be two minutes or ten, may not make very much difference, so far as immediate injury to the germ is concerned; and that most of the damage may be done when the grain is drying, for the strength of the solution with which the germ is wetted is increasing continuously until saturation is reached, and even when a relatively weak solution has been used, the germ is covered by a saturated solution immediately before the dissolved bluestone is deposited on it. The stronger the solution which is used, the longer is the germ in contact with a saturated solution; and this is probably the reason why a strong solution is the more harmful. It may be found that the best method of treating grain with bluestone is by immersing it for a short time in a relatively strong solution and placing it in water immediately afterwards to wash off or greatly dilute the solution on it. The great drawback to this method is that it leaves practically no film of bluestone on the seeds to protect them from fresh infection if bunt-balls in the bulk should happen to get broken in the subsequent handling of the grain. This season the dryness of the soil has caused the germination of seeds which have been treated with bluestone to be both slower and poorer than usual in the experimental plots both at Wagga and Lambrigg. I have on that account begun some experiments at the Wagga farm to see whether an effective treatment with bluestone can be devised, which will leave the germ uninjured. In these experiments the seeds have been planted somewhat shallower than usual, and this has doubtless enabled some plantlets to get above ground which the treatment would have made too weak to penetrate a thicker covering of soil. The experiments which are in progress are two. For the 1st, which for convenience I will call experiment A, 300 seeds of the new variety, "Federation," after being badly infected, were immersed for five minutes in a 1 to 30 solution of bluestone, and then placed in water for one minute. They were then dried and planted immediately afterwards—on 9th July. For Experiment B, the same number of seeds taken from the same bulk were placed for five minutes in a 1 in 100 solution of the same bluestone and then dried without being placed in water. These seeds were also planted on 9th July, in drills adjacent to those of Experiment A. On 13th August 253 plants, or 84⅓ per cent. of the number of seeds planted, were above ground in experiment A; and in Experiment B, 277 or 92⅓ per cent. On 25th August the number of plants in Experiment A was 263, representing 87⅔ per cent. of the seeds sown; while only 275 plants, or two less than on 13th August, were alive in the drills of Experiment B. It will be seen, therefore, that so far as the germination of the treated seeds is concerned, experiment B has given decidedly the better results; for in it the germination has been quicker and the stand is better. Experiment A also (according to the last report I have received, which is dated 26th August) "contains the most weak plants." It remains, however, to be seen which of the two treatments is the more efficient for the killing of bunt-spores.* The immersion in the stronger solution was undoubtedly too long. Next year I hope to see what results follow from shorter immersions; but at present I am inclined to hope for more from another experiment which is in progress at Lambrigg, in which the weaker solution (1 to 100) is used, and an effort has been made to get a thicker film on the treated grain by mixing a little gelatine with the solution.

(2.) *Corrosive Sublimate.*—This substance has thus far shown itself to be as reliable and effective for killing bunt-spores as any of the fungicides which have been tried. It has to be used in an exceedingly weak solution; and the film which is left on the seeds after drying is apparently too thin to afford much protection against re-infection. In this respect it is inferior to bluestone. The main objection, however, to its use is that it is exceedingly poisonous, and that from being in the form of small white crystals there is much danger of its being mistaken for some such harmless substance as common salt. Table III shows what good results it gave last season, when it was used in a solution of the strength of 1 to 400; and were it not for its being such a dangerous poison, and unsafe to have on a farm, I would certainly recommend its use.

*Formalin.*—This fungicide has also given a good account of itself in the trials which have been made with it. Although all the drills, for which it was used, have not been free from bunt, bunty plants have been found in very few of them, and in very small numbers; and they were quite likely to have been caused by re-infection, which it is hard to avoid when spores are being handled. When seed-grain has been treated with formalin, not only does the solution adhering to it not become stronger when the grain is being dried, but exposure to the air makes it weaker. If injury, therefore, is done to the germ, it is most probably done during the immersion and not afterwards. Of course treatment with formalin affords no protection against re-infection. As it leaves no protective film on the seeds, it is necessary to free a bulk of grain from bunt-balls before it is treated with this substance. And this it is not difficult to do; for uninjured balls, which alone cannot be penetrated by the fungicide, refuse to sink in water. All that it is necessary to do is to pour the grain, before it is treated, into a suitable receptacle filled with water, in such a manner that the bunt-balls it contains will not be carried and kept down by the grain. The balls will then be left floating, and can be skimmed off. The grain ought to be well stirred with a rake while it is in the water; this will release any bunt-balls which are being kept down by grain lying on them, and will break up partially broken balls which have sunk and become soft. If the grain has been very badly infected, the water will be made dark with spores. In that case it will be well to pour the water off and wash the grain over again with a fresh supply. The subsequent treatment consists of putting the grain, about 2 bushels at a time, into bran or chaff bags and immersing it for from five to ten minutes in a solution of formalin made by pouring the contents of a 1 lb. bottle into a cask containing 45 gallons of water. The strength of this solution will be 1 oz. of formalin to 28⅛ lb. water, or 1 to 450. Care will need to be taken to immerse the whole of the bag, otherwise the grain is likely to get infected afresh by spores on the neck of the bag. The grain is dried by hanging the bag up in a draughty place. Formalin is much less dangerous to use than either corrosive sublimate or bluestone, although it is poisonous in the concentrated form in which it is sold. In regard to its poisonous qualities, Prof. R. A. Moore, of the Wisconsin Experiment Station, says in connection with the treatment he recommends for seed-oats, of soaking it for twenty minutes in a solution made by adding 1 lb. of formalin to 50 gallons water (equivalent to 1 oz. to 30¼ lb.): "This solution is not poisonous to stock in moderate amounts. Oats that have been treated and dried can be fed to stock. If more oats are treated than are needed for seed, it is advisable to mix the treated oats with oats that have not been treated, before feeding. The grain sack or clothing coming in contact with the formaldehyde solution will not be injured. The solution will keep for a week or more, but it is advisable to cover it up when not in use." If for any reason the solution has to be kept, it should be placed in a dark place. If a bottle is opened, owing to the fact that the formalin is only formaldehyde gas dissolved in water, it will not be enough merely to cork it up, but wax or something to hermetically close the bottle should be placed over and around the cork. If this be not done, the formalin will lose its strength from the gradual escape of the gas it contains. Prof. Moore says of the above treatment for oats that "it seems to facilitate the sprouting. A difference of from two to four days in favour of oats treated was noticeable this season." My own experience of the germination of wheat which has been treated with formalin is hardly so favourable. Strong solutions of formalin certainly do injure its germinating quality seriously; but in the experiments in which I have used as weak solutions as 1 to 400, I have in every case, when the stand has not been satisfactory, had good reason for attributing it to some other cause than the treatment. I have also found that when bulks which have been treated with solutions of greater strength than that which I am recommending—in fact with 1 oz. to 22½ lb. of water, or 1 to 360—they have given very satisfactory stands. On account of the ease with which it can be used, its cheapness, and what Prof. Moore says of its non-poisonous qualities, I think that formalin is to be preferred to either corrosive sublimate or bluestone for treating seed wheat for bunt; and I recommend as safe and practicable a solution of 1 lb. to 45 gallons of water (or 1 oz. to 28½ lb., or 1 to 450), to be used in the manner I have described.

---

* I have received the results of these experiments. In Experiment "A" 266 plants arrived at maturity; and all were quite free from bunt. In Experiment "B" 277 ripe plants were counted, and of them three were bunty. Experiment "A," therefore, has given results which are worth following up.

## Appendix.

THE excessive dryness of the seed-bed at planting time caused last season to be very unfavourable for comparative experiments with fungicides for the treatment of bunt-infected seed. The experiments which were made at Lambrigg were on that account so few in number that a description of them and the results they gave can be attached to this paper.

(1.) In the first experiment the infected grain was soaked for six minutes in a solution of formalin of the strength of 1 oz. of formalin to 28½ lb. of water; 115 plants arrived at maturity, and all bore heads which were free from bunt.

(2.) The second experiment only differed from the first in the respect that the solution of formalin was allowed to stand for twenty-four hours before the infected seed was immersed in it. It was kept in a dark room, in a small tub, with a towel over it; 114 plants produced seed, and the heads were all bunt free.

This shows that a solution of formalin of the above strength retains fungicidal qualities for twenty-four hours, if it is kept in the above manner.

(3.) In this experiment the seed was soaked for four minutes in a 1 to 40 solution of bluestone, then dried and afterwards infected; of the ninty-three plants which grew four produced bunty heads.

(4.) In this experiment the treatment the seed received was in every respect the same as in (3) with the exception that the solution of bluestone was made with water in which gelatine had been dissolved at the rate of 1 oz. of gelatine to 12½ lb. of water; seven of the ninety-five plants which grew had bunty heads.

Experiments (3) and (4) appear to show that the thickening of the film in the dried seed by means of gelatine did not add to its protective qualities.

(5.) In this experiment the seed, after being infected, was soaked for four minutes in a 1 to 100 solution of bluestone; nine of the seventy-five plants in the drill had bunty heads.

(6.) This experiment only differed from (5) in the circumstance that the bluestone was dissolved in water in which gelatine at the rate of 1 oz. of gelatine to 12½ lb. of water had been dissolved. The heads of the seventy-six plants which grew from the treated seed were all quite free from bunt.

For these six experiments seed from the same bulk of the variety "Yandilla" was used, and the planting was done on 3rd September. The results—the fewness of the bunty plants—lead me to suspect that Yandilla may be a resister of bunt.

In addition to the above a large number of experiments were made at Lambrigg and Bathurst in sowing bunt-infected seed of unfixed and partially fixed cross-breds, with the object of seeing into the possibility of making varieties which are valuable on account of the resistance they offer to the infection of bunt. No good purpose would be served by describing these experiments in detail. The results, however, from sowing seeds produced by plants of the variable generation which were free from bunt in 1901, are exceedingly encouraging, but it remains to be seen whether and to what extent these good results are due to the exceptional character of the season.

# The Quantity of Wheat to Sow per Acre.

R. W. PEACOCK.

Owing to the scarcity of wheat for seed purposes and the high prices ruling, the question of thick and thin seeding is a most important one and worthy of the consideration of all wheat-growers.

It is a notorious fact that many thousands of bushels of seed wheat are wasted annually by farmers sowing too thickly. I will endeavour to explain how smaller quantities may be sown to greater advantage.

No hard and fast rule can be laid down as to the most desirable quantity to sow per acre, as much depends upon the preparation of the seed-bed, time, and method of seeding, variety, size, and quality of the grain, nature of soil and climate, and the freedom of the land from weeds.

In discussing the various points I trust that many farmers may arrive more easily at the most economical quantities to suit their varied conditions.

## The Preparation of the Seed-bed.

In order to ensure a large percentage of plants from the grain sown the seed-bed must be in a suitable condition. In a field which has been simply ploughed and the grain broadcasted upon the surface, it very frequently happens that a proportion of it falls to the full depth of the ploughing, especially if the land has been out to pasture for some time. Such grains may germinate 5 or 6 inches below the surface, but the plantlets rarely, if ever, are able to get to the light, and consequently perish. The losses in this way are sometimes very heavy, especially when the conditions are not favourable to germination. An extra cultivation in the preparation of the soil at this period is one of the best investments of the farmer, and the results are often very marked throughout the subsequent growth of the crop.

## Time of Sowing.

Owing to the stooling or tillering proclivities of wheat, 30 lb. to the acre sown during March or April would in some varieties produce as great a number of ears at harvest time as twice that quantity sown during June or July. This fact is well known to farmers, and in practice very much more seed is required for the later than for the earlier sowings. It is, of course, taken for granted that the grain is sown in soil sufficiently moist to ensure germination.

## Methods of Sowing.

These are divided into two divisions, viz., broadcasting and drilling. There are various modes of broadcasting, ranging from the distribution by hand to the various machines used for that purpose, with varying degrees of efficiency. Those which distribute the grain most evenly and allow of its being covered at a uniform depth are preferable. By broadcasting it is impossible to ensure the uniform covering of the grain as by drilling. The drill can be regulated so as to deposit the seed uniformly below the surface at the desired depth, which ranges from 2 to 3 inches. This ensures uniform soil temperature and moisture, resulting in a larger percentage germinating. Generally speaking, in drilling about one-third less seed is required than in broadcast sowing.

## Variety.

The question of variety is a most important one, and one not often recognised by farmers. There are many wheats which possess the ability to stool or tiller largely, whilst others are but meagre stoolers. So much is this the case that a bushel per acre of some varieties would not produce as many ears as half a bushel of others. The long-season wheats are invariably profuse stoolers if given suitable soil and sown sufficiently early. The earlier maturing varieties are almost always sparse stoolers. The Lammas, Tuscans, and many of the Purple Straws belong to the former, whilst King's Jubilee, Early Para, and many of the new crossbreds belong to the latter.

## Size of the Grain.

The size of the grains exercises considerable influence over the number of plants from a bushel. A bushel of the small grains of Allora Spring, other things being equal, would produce a great many more plants than a bushel of the large grains of the Macaroni wheats, or those of the larger-grained bread varieties. When the size of the grain of the same variety varies from different causes the plumpness or otherwise affects the result similarly, if grown under ideal conditions for germination. On the other hand, if the conditions are not so favourable, the plump grain would have the advantage of the shrivelled. Plump grain allows of deeper sowing than the shrivelled, also its greater vitality and larger reserve of plant-food would enable it to withstand more adversity, and thus the apparent advantage of the inferior sample in containing more grains per bushel may be more than counterbalanced by advantages possessed by the better sample.

## Quality of the Grain.

From the foregoing it will be seen that size is sometimes related to quality. Some wheats produce small grains of excellent quality, and quality in a wheat required for seed purposes is represented in its purity, vitality, and inherent robustness. Shrivelled, immature, and cracked grains detract considerably from the quality of the sample, and also lower considerably the number of plants germinating per bushel.

## Nature of the Soil.

The richness of the soil, consistent with its being a wheat soil, has also an influence upon the amount of seed to sow per acre. Soils moderately rich in vegetable matter induce heavy, and poor soils sparse, stooling. The light soils can be sown to advantage earlier than the heavy ones.

## Nature of the Climate.

Conditions of climate must be taken into consideration. In the semi-arid regions, where the rainfall is limited, individual plants require more soil space from which to obtain moisture, and if the crop were thick, the limited moisture might be exhausted before it could mature grain. Under such conditions a quarter of a bushel would give better returns than half a bushel per acre, whereas a heavier seeding would result in disaster. Under very moist conditions a bushel per acre, or even more, of the more common varieties may produce a maximum crop, the heavy crop carrying off the excess of moisture, and thus ensuing better results.

## Weeds.

The possibility of the land becoming foul with weeds must enter seriously into the questions discussed. Thin seeding encourages the growth of weeds often to the serious detriment of the crop. On the other hand, a heavy seeding may result in choking the weeds almost to their total exclusion. Such land should be freshly worked before sowing, and only sown when moist enough to ensure the rapid germination of the grain, in order that the wheat crop may get the advantage over the weeds.

## Results of Comparative Experiments.

In reviewing the foregoing it will be apparent that this question presents many aspects, and that the laying down of any hard and fast rule is impossible, and only attempted by those who are not conversant with the subject. A study of the many conditions is essential to the economical seeding of any farm to ensure the maximum returns.

Many farmers are sceptical as regards the beneficial results of thin seeding under any conditions whatever, sticking to the old-time fallacy "that if you do not put the seed on heavily, you will not reap heavily." This I will admit is more applicable to English agriculture, but certainly is the reverse of the truth as applied to many of the conditions of the Australian States. My experiences have not led me into becoming an extremist, as has been claimed for a few who have been misunderstood upon this question. Yet the results I have obtained from light seedings may seem incredible to many who are not conversant with the conditions under which the experiments were conducted.

I would first of all have it understood that the quantities of seed per acre given were of seed of perfect quality and thoroughly graded to the exclusion of all the imperfect grains, &c.; also that the seed-beds invariably were in perfect condition, and the grain was sown with the drill. At the Coolabah Experimental Farm, where the conditions may be termed arid rather than semi-arid, during one season with a rainfall very much below the profitable wheat-growing rainfall, a seeding of 10 lb. per acre, sown in drills 16 inches apart, gave much better results than a seeding of 20 lb. sown 8 inches apart, whilst a seeding of 30 lb. proved a complete failure. The crop yielded from the 10 lb. seeding was not a profitable one, as the rainfall would not allow of such being grown throughout that year. From many observations carried out at that farm, the quantity of 20 lb. per acre was decided upon as the maximum amount to sow under the conditions obtaining.

In order to demonstrate more fully the possibilities of a 20 lb. seeding, a favoured portion of wheat, growing in a position to obtain a considerable soakage from a cowal or small lagoon, and also benefited by the decayed vegetable matter which had previously been deposited over it by past floods, was measured carefully, reaped and weighed, and yielded at the rate of the exceptionally heavy return of 65 bushels per acre. The variety was "Farmer's Friend," and in all my experience I had never seen a more perfect crop of wheat.

At the Bathurst Farm last year, under conditions which certainly must be termed droughty, the best yields were obtained from early sowings of from 20 to 25 lb. per acre, the yields being from 20 to 22 bushels per acre. In the light of such experiences, I am forced to the conclusion that many thousands of bushels of seed wheat are wasted by the too heavy seeding throughout many districts of this State, and feel sure that if more attention were given to a more thorough study of the conditions, &c., a great saving might be effected during this season when economy enforces her claims.

## GROWING KURRAJONG TREES FROM SEED.

In answer to inquiries, Mr. J. H. Maiden, Government Botanist, has furnished the following directions for raising Kurrajong trees from seed:—Select fresh, ripe seeds, usually available about the month of May or June; remove them from the pods by hand in order to ensure them against bruising.

For a seed-bed choose some good alluvial deposit having a good proportion of coarse sand in it, also mix well through it some fairly well decomposed leaves or vegetable matter in the proportion of one-third of the alluvial soil. If sowing in boxes place some loose rubble or broken crockery in the bottom, then scatter a few leaves over the layer to prevent the soil washing through, and fill up with soil prepared as indicated to within 3 inches of the top, pressing down fairly solid. It would be better to sink the boxes into the ground level with the surface to prevent too rapid drying. Sow the seed fairly thickly, almost touching each other, and cover them with soil to a depth of ¼ inch, or the thickness of the seed (which is an almost infallible guide in sowing seed), then water heavily and mulch with leaves to preserve moist condition of the soil until germination takes place. In the following autumn or winter the young Kurrajong plants should be fit for transplanting to their permanent position.

# Condensed Milk.

M. A. O'CALLAGHAN.

In the January issue I dealt with this subject to some extent, and since then the question has assumed considerable importance owing to the Board of Health Regulations regarding the use of preservatives in food products. In the previous article on this subject, which was intended for continuation, the question of preservatives in condensed milk was just touched on. Therein I stated that the use of chemical preservatives should not be allowed in condensed milk which is put up in sealed tins or vessels. This requires some qualification.

## Condensed *v.* Concentrated Milk.

Every educated person knows that the words "condense" and "concentrate" have similar meanings. The term "concentrated," as applied to milk, has, however, in Australia a trade meaning to distinguish it from condensed milk as generally known. Concentrated milk, it might be stated, is a product peculiar to Australia, as far as the manufacture is concerned. Its place is taken in European countries by what is termed unsweetened condensed milk. There is, however, a technical difference between the two products, and perhaps the best way to explain the difference is to give a definition of each. "Condensed" milk might be defined as milk from which a considerable portion of the water has been evaporated, which has been sterilised by the action of heat, and which may or may not contain sugar other than milk sugar. "Concentrated milk" might be defined as a "pasteurised" milk from which a certain percentage of water has been evaporated, and which contains no sugar other than milk sugar. There is also an essential difference in the manner in which these articles of food are put up. Condensed milk is, as everybody knows, put up in what are known as 1 lb. tins, these tins being well filled and thoroughly sealed. Concentrated milk, on the other hand, is generally put up in tins holding about one gallon, and sometimes, such as in Melbourne and in Sydney, it is distributed from an open vessel similar to fresh milk, it having been concentrated a day or two previously. Concentrated milk is not intended for long-keeping purposes, nor will it, unless kept in a low temperature in cold store, keep fresh for more than a few days. Its principal market is for use on board a ship, where it is preferred by a great many to a sweetened condensed milk. While dealing with this part of the subject it might be well to refer to the report of the Departmental Committee appointed by the Board of Agriculture in England, to inquire and report upon the regulations which it might be desirable to make regarding the sale of milk and cream. Quoting Lehmann, the Committee state:—"There are four distinct classes of condensed milk, viz, (1st) whole milk, sweetened and unsweetened; and (2nd) machine skimmed milk, sweetened and unsweetened." Mr. Lehmann stated that the unsweetened brands were not largely sold, except for ship's stores and for export, for which he gave the following explanation:—" We deal with a pretty big quantity of condensed milk, and our experience is that we cannot get the public in England—and our public is the lower class public, not the higher class public—to take the unsweetened condensed milk. In countries where condensed milk has been recently introduced—in Rhodesia for instance, where condensed milk was introduced after the rinderpest—it is the unsweetened milk that has gone ahead, and which sells very much more than the sweetened milk, because there the public have had practically both kinds of milk, the sweetened and the unsweetened, offered to them at the same time, and they have, as I should naturally do myself, taken to the unsweetened; but in this country, where the public taste has been educated to sweet milk, we cannot get them to take unsweetened milk."

Referring to the addition of sugar to condensed milk, the report states:—" Whatever the reason may be, the fact was referred to by several witnesses that many of the condensed milks on sale contain a very large amount of sugar—as much as 40 per cent in some cases. The effect of this is, that it is necessary to add a large quantity of water to dilute them sufficiently for use. Mr. Allen mentioned one of the best known condensed milks, the makers of which say on the label that, for the purpose of feeding chidren, it should be diluted with from 12 to 14 parts of water, and he added, 'seeing that it never was concentrated more than 3 down to 1—not 12 or 14 down to 1—it means that the children who are served with that milk diluted to that extent, in accordance with the directions of the manufacturers, are starved.' Other witnesses gave evidence to the same effect, and there is no doubt that the state of affairs thus disclosed is prejudicial to the health of the community. The suggestion was made by Major Cassal that the addition of sugar to condensed milk should be either prohibited, or if that were deemed undesirable, it should be made compulsory to disclose the fact on the label"

The way is now clear to discuss the question of the use of preservatives, other than cane sugar, in condensed and concentrated milks. Of the eighty-six samples of condensed milk which were examined in the Government Laboratory, London, at the instance of the Departmental Committee appointed in 1899 to inquire into the use of preservatives and colouring matters in the preservation and colouring of food, none were found to contain chemical preservatives. This would go to show that the use of preservatives, either in sweetened or unsweetened condensed milk, is unnecessary, and hence should be prohibited. Condensed milk is, however, not made to a very large extent in Australia, and the sweetened brands of milk, or those to which cane sugar has been added, do not, as far as I know, contain any other preservatives. With concentrated milk, however, the case is different. Nearly all, if not all, the concentrated milks manufactured in this country contain some preservative—boric acid being the commonest used.

The question now arises,—What shall be regarded as concentrated milk as distinguished from condensed? Our factories have built up an industry in concentrated milk, and this milk has been used on ships trading to various parts of the world. Moreover, it is reported to be more popular and more in request for this purpose than condensed milk. No doubt its preference, if there is a preference, over unsweetened condensed milk arises from the fact that owing to the manufacture being more simple, and the packages in which it is put up much larger, it can be supplied at a lower rate. Hence it would be a pity to introduce legal measures which, if not absolutely necessary for the health of the community, would materially interfere with a progressive industry. In a report to the Minister for Agriculture, which has already been published in the daily Press, I gave it as my opinion that if the concentrated milk industry was to be carried out on its present basis, it would be necessary to allow a preservative to be used in the manufacture; and I stated, as a limit which should not be exceeded, that ·25 of boric acid might be allowed in the manufacture. By this I mean that before the process of concentrating or condensing really begins, the manufacturer might be allowed to add an amount not greater than ·25 per cent. to the milk which is to be concentrated. This would work out at something between ·5 and ·75 per cent. of boric acid in the finished product, according to the degree of concentration, which generally averages about one-third of the original product. All the boric acid added will not appear in the finished product when an analysis is being made. For this reason, and also because the degree of concentration varies considerably, I mentioned the amount which I thought it advisable to limit manufacturers to when adding boric acid to the original milk. What wants to be done, however, is for the manufacturers to see how much of the original preservative added will be afterwards determined by the analyst in the finished product. Then, when they know this, the next item to work out is a regular degree of concentration, and knowing, or having acquired, these two, they should be able to know what amount of preservative to add to the original milk before evaporation begins, because it is at this stage the preservative will have to be added if boric acid is used. I have no doubt that, as a general rule, ·5 per cent. of boric acid in the finished product would be sufficient to ensure the necessary keeping qualities to concentrated milk. On the other hand, however, during some of our most trying summer weather, this limit may not be quite high enough to enable the manufacturer to turn out a product with the necessary keeping qualities. It is, however, a question of care, cleanliness, and skill, and it might be argued that the fault lies with the farmers who produce the milk, and that they should be compelled to deliver it at the factory in a condition which will enable the manufacturer to produce the required article with the limit of ·5 per cent. of boric acid in the finished product.

## Antiseptic Properties of Boric Acid.

The action of boric acid on the growth of lactic acid producing bacteria, or, in other words, its effectiveness in preventing the souring of milk, will depend, to a great extent, on the accompanying conditions.

The following experiments will, however, be of some help in coming to a conclusion on the amount of boric acid which it is necessary to employ in the concentrating of milk.

Several flasks were taken and thoroughly sterilised. 100 cc. of new milk, to which various percentages of boric acid had been added, were then introduced into the different flasks, and the whole lot steamed in a Koch steriliser at 212 degrees Fahr. for fifteen minutes. The gas was then turned off, and after five minutes the flasks were removed and cooled by immersion in cold water. They were then allowed to stand for a little time, and 10 cc. of a twenty-four-hour-old pure culture of *B. acidi lactici* were added, and the flasks again stoppered with cotton wool. Observations were made at various intervals, and the experiment was repeated with the following result:—The control flasks, to which no boric acid had been added, coagulated in two days, as did the sample to which ·25 per cent. of boric acid had been added. The flask containing ·5 per cent. of boric acid in one instance coagulated in two days, and in the other experiment in four days; the same milk, to which 1 per cent. of boric acid had been added, taking ten days to coagulate. In a third experiment similarly carried out, milk to which ·75 per cent. of boric acid had been added, coagulated in five days, and that to which 1 per cent. had been added coagulated in twelve days. This experiment would go to show that ·5 per cent. of boric acid will not prevent the growth of lactic acid bacteria in milk; but that it will in some instances delay considerably the growth of these organisms in highly pasteurised milk. On the other hand, it would appear that ·75 and 1 per cent. of boric acid, very materially check the growth of these bacteria, although these amounts do not entirely prohibit it. Concentrated milk under the same conditions should not go sour as quickly as the milks subjected to these experiments, because it is thicker, and also because it is subjected to a fairly high temperature, though not so high as 212 degrees for a considerably longer time than a quarter of an hour, and also because the lactic acid or other organisms that would gain access to the milk after heating, or which remained undestroyed by heating, would not be present in nearly such large numbers as those specially introduced into the flasks in the above experiment.

Another experiment which, perhaps, bears more directly on the case, was carried out as follows:—Five flasks were thoroughly sterilised, and 100 cc. of milk which had been passed through an ordinary pasteurising machine were introduced into each flask. One of the flasks was used as a control, and to the other four varying percentages of boric acid were added, and observations made, the flasks being kept stoppered with cotton wool. The control flask to which no boric acid had been added had coagulated in twenty-four hours; that to which ·25 per cent. of boric acid had been added took forty-one hours to coagulate; that to which ·5 per cent. of boric acid had been added took 100 hours to coagulate; that to which ·75 per cent. of boric acid had been added took 120 hours to coagulate; and that to which 1 per cent. of boric acid had been added took 260 hours to coagulate. This experiment clearly shows that boric acid, even in such small quantities as ·25 per cent., has a considerable action in delaying the growth of lactic acid producing bacteria. On the other hand, it was found that butyric acid fermentation had set in, in all flasks, and even in those which contained ·75 and 1 per cent. of boric acid, butyric fermentation was strongly noticeable for two days previous to coagulation.

Hence it is clearly demonstrated that 1 per cent. of boric acid in milk will not entirely prevent either lactic or butyric fermentation, and thus it becomes a necessity for manufacturers of condensed unsweetened milk to sterilise that product by means of heat. This is not so easy as it appears to the uninitiated. The milk may be practically rendered sterile before it leaves the vacuum pan; but then it has to be cooled down and put in tins, and as this part of the work cannot well be done in a filtered atmosphere, it means that moulds and bacteria will again gain access to the milk and to the tins, resulting in due course, unless other measures are taken to destroy them, in these agents of fermentation, setting up their usual actions, and causing the milk to be useless for human consumption. I have seen hundreds of tins of produce thus ruined, and it is at this stage of the manufacture that skill and experience are most needed, and here it is that the line of demarcation between concentrated and condensed milk widens to the utmost. The concentrated milk is now packed into tins, generally holding about 11 lb., and is ready for despatch to market. Not so the condensed milk, which is required to keep in all temperatures, and for long periods of time. It is packed into smaller tins (about 1 lb., as a rule), and processed and reprocessed before it is ready to take its place on the markets of the world. If the milk is packed in large tins it becomes practically impossible to process the milk without coagulating, and thus ruining it. Hence it is that concentrated milk manufacturers claim that they cannot guarantee the manufacture of a reliable, concentrated, pasteurised product on the same lines as at present without the use of a chemical preservative. On the other hand, the absolutely anti-preservative man may say, "Manufacture condensed unsweetened milk thoroughly sterilised by means of heat, pack it in 1 lb. or 2 lb. tins, and let concentrated milk go to the wall." The concentrated milk man will probably reply, "Our milk is better for humanity; it is pasteurised rather than sterilised, and is thus more easily digested; and it is cheaper, and thus meets the wants of the poorer classes better, and it will keep longer when exposed to the air."

## Composition of Condensed Milks.

A fat analysis of most of the milks now sold in Sydney has recently been made in this laboratory, with the following results:—

| | | | |
|---|---|---|---|
| Ideal brand (unsweetened) | | 11·09 | per cent. |
| Rowansborn brand (unsweetened) | | 10·90 | ,, |
| Nestles ,, | (sweetened) | 10·73 | ,, |
| Anglo-Swiss ,, | ,, | 10·30 | ,, |
| Gold Medal ,, | ,, | 10·30 | ,, |
| Highlander ,, | ,, | 10·22 | ,, |
| Map brand skim milk | ,, | 1·53 | ,, |

One of the recommendations made by the Departmental Committee already referred to is as follows :—

> That any condensed milk (other than that labelled machine-skimmed milk) in which either the amount of fat is less than 10 per cent., or the amount of non-fatty milk solids is less than 25 per cent., shall be deemed to be not genuine.

The following table, which is given in the Departmental report alluded to, will be of interest to manufacturers and consumers in this State :—

| Brand. | Degree of condensation. | Fat calculated in original milk. | Brand. | Degree of condensation. | Fat calculated in original milk. |
|---|---|---|---|---|---|
| Ideal... ... .. | 2·48 | 4·63 | Sledge ... ... | 2·81 | 3·89 |
| ,, ... ... ... | 2·49 | 4·33 | First Swiss ... | 2·82 | 3·53 |
| ,, .. ... ... | 2·52 | 4·50 | Viking ... ... | 2·82 | 3·70 |
| ,, ... ... .. | 2·54 | 4·62 | ,, ... ... | 2·85 | 3·56 |
| ,, ... ... ... | 2·55 | 4·45 | ,, ... ... | 2·86 | 3·86 |
| ,, ... ... ... | 2·55 | 4·13 | ,, ... ... | 2·93 | 3·32 |
| ,, ... ... ... | 2·85 | 2·97 | Sledge ... ... | 2·92 | 3·98 |
| Sledge ... ... | 2·80 | 3·86 | First Swiss ... | 3·08 | 3·47 |

This table was handed in by Mr. Lewin, of the Government Laboratory, London. From this table it would appear that the ratio of condensation is smaller in the rich milks than in the poorer. This is only in accordance with what might be expected, as the more solid matter in the original milk the less water will require to be evaporated to bring it to the average consistency of condensed milk.

## General Technique of Manufacture.

(1.) The milk is sometimes separated or centrifuged to remove all possible impurities before starting.

(2.) The milk is now warmed (sometimes boiled) and sugar added when sweetened milk is to be made.

(3.) Some factories heat it in open vats for some time before placing it in the vacuum pan. This is to help sterilisation.

(4.) It is then evaporated till only a little more than one-third of the original amount remains, the evaporation being carried on in a vacuum pan, where the milk boils for a couple of hours. The temperature at which the milk is evaporated is an important point.

(5.) After evaporation has been completed to the desired point the milk is drawn off, cooled, and packed in tin vessels.

(6.) If concentrated milk is required the process is now complete, but if sterile milk (condensed) is required, further heating is carried on, and this is what is technically known as processing the milk.

(7.) The milk is then held for some time to test its keeping quality before sending it to market.

# Dairy Notes.

M. A. O'CALLAGHAN.

## FIFTH STATE BUTTER SHOW.

THE fifth State butter show organised by the Dairy Branch of the Department of Agriculture was recently carried out under the conditions and with the results given below.

Ten entries were received, which meant a total of forty boxes for examination.

In every case but one no difference was discernible between the flavours of the duplicate boxes on first examination, which showed that the lots presented for selection were made on the same date, and possibly from the same vat of cream.

### *Conditions and Regulations.*

(1.) The competition is open to all butter factories in New South Wales.

(2.) The date of the beginning of the exhibition shall be 19th November.

(3.) The last day for receiving entries shall be 15th November. Entrance shall be free.

(4.) The prizes shall be as follows ;—
1st prize—Gold medal and certificate.
2nd prize—Silver medal and certificate.
3rd prize—Certificate of merit.

(5.) The exhibition shall consist of four boxes of butter from each factory, two to be selected each week between 19th November and 4th December inclusive.

(6.) The following method of selection will be observed :—Each competing factory shall, through their representatives in Sydney, place at the disposal of the officer of the Department at least twenty boxes of butter at one time each week, from which the officer shall select any two he may think fit. The other boxes may be marked so that they cannot be presented a second time.

(7.) Method of judging :—As in previous State shows, the two boxes selected for competition shall be taken to the cold stores leased by the Department, and judged a first time. The boxes shall then be placed in cold store for six weeks weeks and judged a second time for flavour to determine the keeping qualities. The awards will be based on the final judgment.

(8.) Scale of points on which judgment will be based ;—

| | |
|---|---|
| Flavour ... ... ... ... .. ... | 50 points. |
| Texture ... ... ... ... ... ... | 25 ,, |
| Packing ... ... ... ... ... ... | 5 ,, |
| Colour and general market appearance ... | 15 ,, |
| Salting ... ... ... ... ... ... | 5 ,, |
| Total ... ... ... | 100 ,, |

The butter is to be salted and packed as if intended for export. The competitor obtaining the highest total of points as a result of the second judging of the two different lots of butter shall, provided other conditions have been observed, be declared the winner.

(9.) A factory shall have the right to make but one entry, but as factories do not always sell through the same agent they may at any time nominate the agent from which to obtain the butter for selection, but butter will only be selected from boxes bearing the recognised brand of the competing factory. A proprietor owning several factories may make an entry from each factory, but the registered brands of the different factories must be given at time of entry.

TABLE showing Points obtained by various Competitors.

| *A.—Butters.* | | | | | | | *B.—Butters.* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Competitors' No. | Flavour. | Texture. | General Appearance and Colour. | Packing. | Salting. | Total. | Competitors' No. | Flavour. | Texture. | General Appearance and Colour. | Packing. | Salting. | Total. |
| 1 | 37 | 21 | 12 | 4 | 4½ | 78½ | 1 | 40 | 23 | 13 | 4 | 4½ | 84½ |
| 2 | 42 | 22 | 12 | 4½ | 4½ | 85 | 2 | 43 | 23 | 14½ | 4 | 4½ | 89 |
| 3 | 42 | 22 | 12 | 4½ | 4 | 84½ | 3 | 42 | 23 | 13 | 5 | 4½ | 87½ |
| 4 | 41 | 22 | 10 | 3½ | 3½ | 80 | 4 | 38 | 23 | 14 | 3½ | 4 | 82½ |
| 5 | 40 | 22 | 10 | 4½ | 4 | 80½ | 5 | 40 | 23 | 13 | 4½ | 4 | 84½ |
| 6 | 36 | 22 | 13 | 4 | 5 | 80 | 6 | 35 | 22 | 13 | 4 | 4½ | 78½ |
| 7 | 38 | 22 | 14 | 4 | 5 | 83 | 7 | 43 | 23 | 14 | 4 | 5 | 89 |
| 8 | 41 | 23 | 15 | 4½ | 5 | 88½ | 8 | 35 | 23 | 13½ | 4½ | 4½ | 80½ |
| 9 | 41 | 23 | 14 | 4 | 5 | 87 | 9 | 40 | 21 | 13½ | 4 | 4½ | 83 |
| 10 | 41 | 22 | 14 | 4½ | 4½ | 86 | 10 | 40 | 23 | 14½ | 4½ | 5 | 87 |

TOTALS, A AND B.

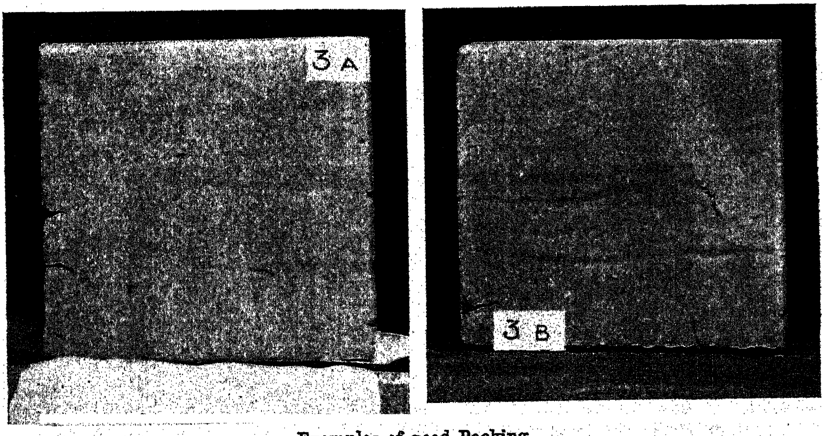
| | | | |
|---|---|---|---|
| No. 1 ... ... | 163 | No. 6 ... ... | 158½ |
| ,, 2 ... ... | 174 | ,, 7 ... ... | 172 |
| ,, 3 ... ... | 172 | ,, 8 ... ... | 169 |
| ,, 4 ... ... | 162½ | ,, 9 ... ... | 170 |
| ,, 5 ... ... | 165 | ,, 10 ... ... | 173 |

Barrengarry Co-operative Dairy Company, Ltd., which is situated in the fertile well grassed and well watered district of Kangaroo Valley was awarded first place, winning that distinction by *one* point from New South Wales Creamery Co., Ltd. (Lismore factory). Barrengarry is much more favoured by nature for the manufacture of a high class keeping butter than Lismore district. In fact, hilly country, well watered, with a sweet close pasture will always produce a better keeping butter than the low-lying rich flat country where the pasture grows luxuriantly. This is the experience in all countries where keeping butter competitions have been carried out.

Third place was responsible for a tie between Berry Central Factory and Crookwell Co-operative Factory. Crookwell district has somewhat similar conditions to Barrengarry, and Berry district to Lismore, in so far that the two former represent districts where the grass is shorter and sweeter than the richer districts round Lismore and Berry, where the pasture is more liable to be luxuriant and consequently more liable to be rank. An interesting feature of the competition presents itself when we know that the butters representing the Berry and Lismore factories were made from pasteurised cream ripened with lactic ferment supplied from the Government Dairy Laboratory, while the butters representing Barrengarry and Crookwell were from ordinary cream. I have, however, been informed that the manager of the Barrengarry factory at the time the butter in question was made very wisely graded the cream very strictly, in fact, so strictly that many of his suppliers grumbled at being only able to obtain second grade. The result proves the beneficial effects of proper grading; but it is to be regretted that the manager in question has since handed in his resignation to the directors owing to a difference of opinion on points of management. It will be noticed that the factory (No. 8) which obtained the highest total of points, viz., 88½, in the first part of the competition obtained very low marks with the second (B) lot of butters. This was the well-known Unanderra Factory, whose manager put in excellently made exhibits. I have since seen him and asked him how it was that such a difference in quality was represented by the two exhibits. His reply was that owing to scarcity of milk, and a great portion of the supply going to Sydney, his clients sent their milk but once a day during the time the second lot of butter was being made. The result was that the milk was too far advanced in lactic fermentation to stand pasteurising properly, and a cream and butter of inferior flavour resulted. The lesson here afforded might be noted with profit by a great many factory managers and farmers.

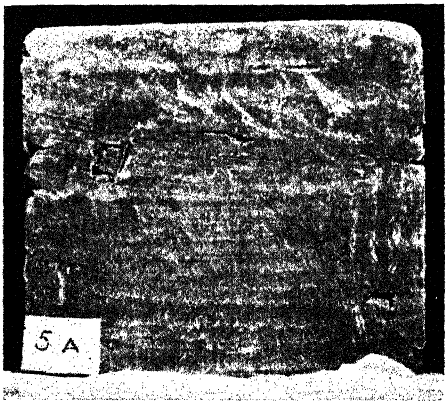
## Faults in the Manufacture.

The principal fault attributable to the butter-maker was that of streakiness. Fully 50 per cent. of the first lot of butters were streaky, numbers 4 and 5 being extremely streaky. There is really no excuse for streakiness. It is the result of insufficient working in of the salt, and generally occurs in factories where the butter is worked but once. It is a most unsightly fault, injuring the appearance of the butter considerably, and also to some extent interfering with the keeping quality of the product. I give on the next page photographs of some of the butters in question, showing the streaks. Needless to point out, these streaks would stand out much more prominently if the photographs were coloured to represent the butter.

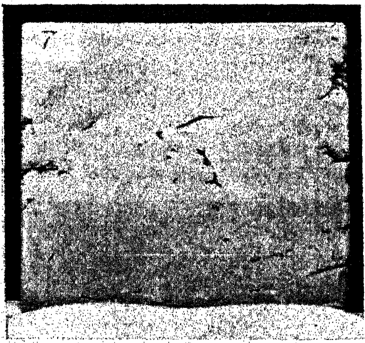


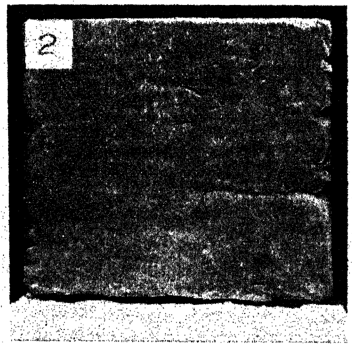
Examples of good Packing.

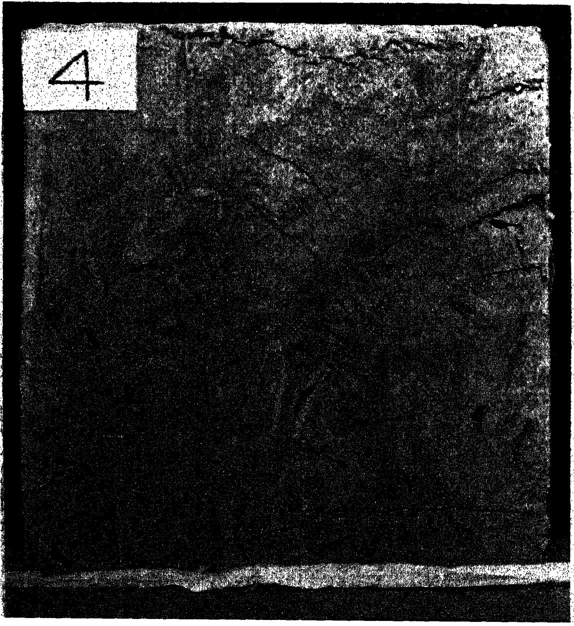
*Packing.*—These photographs will also show the well packed and badly packed specimens. No. 3 represents a well-packed butter showing no air spaces. The irregular packing down the sides, and the consequent air holes can be observed in some of these illustrations. London demands a butter of good texture, closely packed, that will bore well; any tendency to be watery or spongy will ruin the sale of the article, no matter how good it may be in taste and smell. Butter



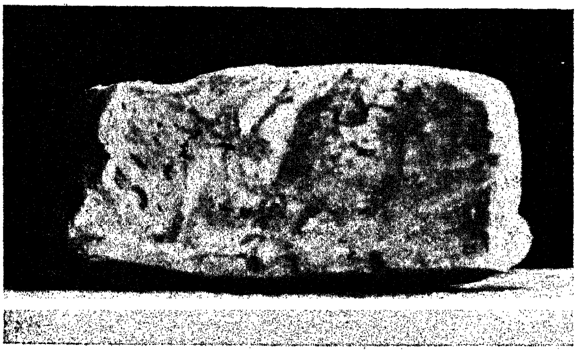
Examples of faulty packing; also showing streakiness of the butter.







loosely packed, with great air spaces in the corners or down the sides of the boxes, will not do. Air must be excluded as much as possible, and this should also apply to the top of the box. A box that will hold 56½ lb. when just full is what is required. An air chamber in the box means that the portion of the butter coming into contact with this air becomes oxidised during transit and will be tallowy to a certain depth. If the boxes are not perfectly seasoned, it will be advisable to line the box with two thicknesses of parchment paper instead of one, such paper having previously been soaked in a solution of salt and preservative. Attention to this point will amply repay factory owners.



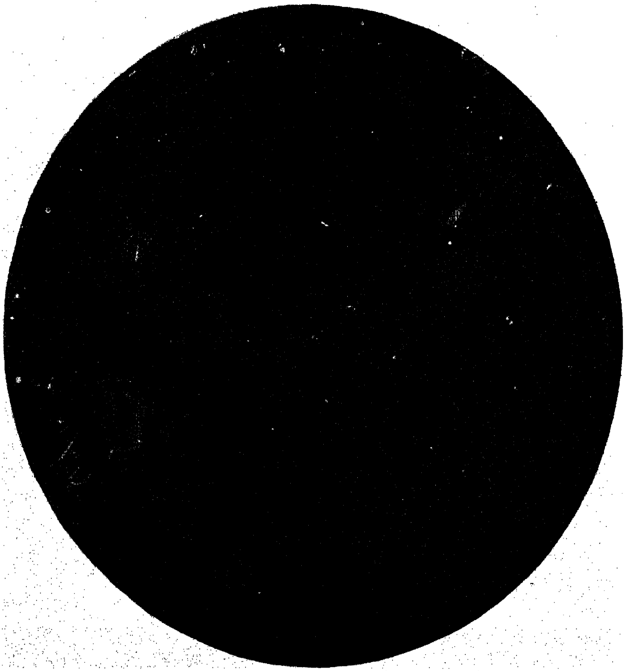
An example of mottled butter.

*Fishiness.*—It is pleasing to be able to report that not a single box of the forty showed a fishy flavour, and in no case was *Oïdium lactis* discovered on the butters being examined bacteriologically.

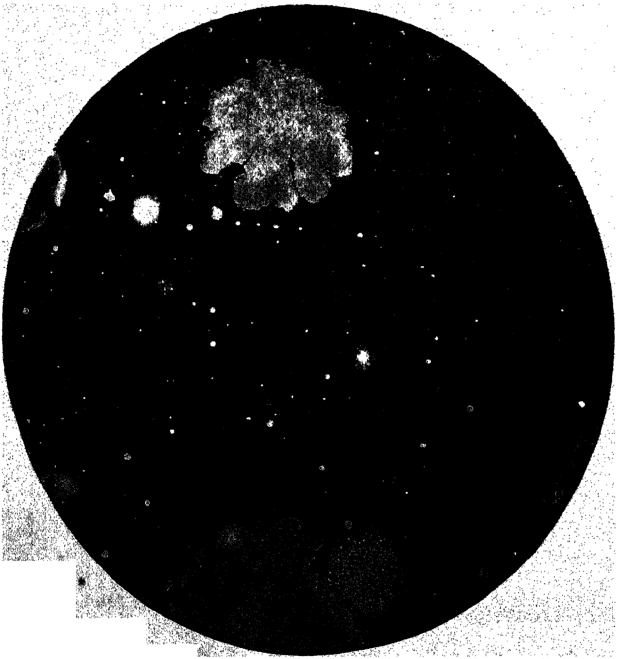
TABLE showing the points obtained for flavour when the butters were first judged, and when judged six weeks later :—

| Marks and Numbers. | Flavour on first judging. | Flavour on second judging. Butters held at 12 to 22 degrees F. | Flavour on second judging of duplicate samples held at 32 to 35 degrees F. |
|---|---|---|---|
| A— 1 ... ... | 40 | 37 | 35 |
| 2 ... ... | 42 | 42 | 40 |
| 3 ... ... | 42 | 42 | 42 |
| 4 ... ... | 44 | 41 | 33 |
| 5 ... ... | 43 | 40 | 38 |
| 6 ... ... | 40 | 36 | 30 |
| 7 ... ... | 41 | 38 | 38 |
| 8 ... ... | 45 | 41 | 37 |
| 9 ... ... | 48 | 41 | 41 |
| 10 ... ... | 41 | 41 | 40 |
| B— 1 ... ... | 40 | 40 | 36 |
| 2 ... ... | 43 | 43 | 38 |
| 3 ... ... | 44 | 42 | 41 |
| 4 ... ... | 44 | 38 | 37 |
| 5 ... ... | 44 | 40 | 37 |
| 6 ... ... | 39 | 35 | 33 |
| 7 ... ... | 45 | 43 | 40 |
| 8 ... ... | 36 | 35 | 35 |
| 9 ... ... | 40 | 40 | 40 |
| 10 ... ... | 43 | 40 | 40 |
| Average of the twenty butters ... ... | 42·20 | 39·75 | 37·55 |

The result of this experiment is practically identical with the results of similar experiments carried out in connection with previous State butter competitions. It is seen that on the average the butters held at the higher temperature, viz., 32 to 35 F., were nearly as much inferior in flavour to the butters held at 12 to 22 F., as were these latter to their original award for flavour when freshly made. The lesson points strongly to the necessity for a lower carrying temperature in the cold chambers of boats taking butter to England, and a lower temperature for delivering our butter to the shipping companies. Then we might expect our butters to travel as well as those sent from New Zealand to England in cold chambers kept below 20 degrees F. The question requires united action on behalf of all the Australian colonies. Not till then can we hope for the necessary reform.



No. 1.



o. 2.

The bacteriological illustrations are photographs of gelatine plates made from two of the competing butters. No. 1 is from one of the prize-winning butters, and contains very few other colonies than those of lactic acid forming bacteria. No. 2 is from a butter that lost considerably in flavour on keeping in cold store, and shows many colonies of gelatine liquefying bacteria, also several mould colonies.

# CHEESE *versus* BUTTER.

FOR some months past market returns have been all in favour of cheesemaking as compared with buttermaking. This has been due to the fact that New Zealand cheese has been almost shut out from our markets by the 3d. per lb. duty. Before the advent of Federation we looked to New Zealand to supply us with good cheese at a reasonable price, and as a consequence when the 3d. per lb. duty was put on we had no ready means of filling the gap caused by the falling off in New Zealand imports. This meant that our demand was greater than our supply, and the position being accentuated owing to the shortage caused by the drought, prices rose rapidly until cheese was at a fictitious price compared with other dairy products. Even now with special brands of cheese at 7d. per lb., and good ordinary at 6d. per lb., the market is in favour of the cheesemaker when compared with the buttermaker. A little over 2 lb. of cheese is obtained from the amount of milk which it takes to make 1 lb. of butter, and with butter at 10d. per lb. it would seem that the relative value of cheese would be about 5d. per lb., judging by the butter-fat value of the milk. There are, however, other features of the question which rob cheesemaking of some of the apparent gilt. The first of these is the decrease in the feeding value of the by-product of cheesemaking compared with that of buttermaking. In buttermaking we remove practically only the fat of the milk, while in cheesemaking we remove not alone the fat but also the casein and most of the albumen, and this means that cheese whey when compared with separated milk is of considerably less value as a food. With cattle and pigs as dear as they are at present this is a very important item, and one that intending cheesemakers must consider seriously. If the milk is utilised for cheesemaking, much more new milk must be reserved for calf-rearing. Calves can be reared by the aid of whey to which maize, porridge, pollard, oil-cake or some such foods have been added, but the calves will require new milk for a longer period than if separated milk be fed as a basis. Other points that count against cheesemaking are: the length of time cheese must be held before it is marketable, during which time interest at, say, 5 per cent. must be calculated on its money value; the percentage of cheeses which go bad in process of ripening and which must be either sold at a reduced price, or used as pig feed; the extra freight on cheese in proportion to its money value, because whereas a ton of cheese is only little better than half the value of a ton of butter it will cost quite as much to send it to market; the extra care which must be devoted to the feeding and watering of the cattle, and the handling and treatment of the milk by the farmer in order to ensure the manufacture of a good cheese which will stand proper ripening.

Climate, soil, pasture, and water all require to be suitable before a good keeping cheese can be manufactured, and these conditions are not suitable over a great portion of our dairy country.

A moist hot climate which causes milk to sour rapidly is not suitable, but if the milk is produced close to the factory this defect can be to a great extent got over by a properly-equipped factory with plenty of refrigerating power.

Soil and pasture might go together, and with regard to these it might be pointed out that the best maturing cheese is made from undulating land not too rich and carrying a close sweet pasture, rank coarse pastures being something to avoid. Last, but by no means least, comes the question of water for the cattle, and here it might be said, the cows must have access to plenty of pure drinking water, or cheesemaking will be a failure. Running streams are best, and failing these, troughs into which good water is placed. Stagnant pools into which cows can walk are fatal to good cheesemaking. The milk got from these cows may be tainted in two ways—first, by the tainted water imparting an unpleasant taste to the milk yielded by cows drinking freely of such water; and second, by bacterial action,—the injurious micro-organisms generally found in such waterholes will adhere with the mud to the cows' hair, and when the animals are being milked later these bacteria get into the milk pail and set up undesirable fermentations in the milk. Gassy curd, so much dreaded by cheesemakers is generally attributable to waterholes of this character.

Let us take the produce from, say, 25 lb. of milk of butter and cheese and compare them.

Suppose we say, as a basis, we get 1 lb. of butter from the milk:—

| | d. |
|---|---|
| This is worth in Sydney ... ... ... | 10 |
| Value of 2 gals. of separated milk ... ... | 1 |
| Total value of 2½ gals. milk ... ... | 11 gross |

This should give us about—

| | |
|---|---|
| 2⅕ lb. of cheese at present value, say 5½d. per lb. ... ... ... ... ... ... | 12·1 |
| 2 gals. whey, at ¼d. per gal. ... ... ... | ·5 |

This gives a gross value for cheese-making of 12½d., as against 11d. for butter-making.

The following deductions for cheese-making should, however, be made as in excess of butter-making:—

| | |
|---|---|
| 5 per cent. for bad cheeses ... ... ... | 0·60 pence |
| 5 per cent. interest on money on cheeses curing for three months ... ... ... ... | 0·15 „ |
| Difference between freight on 1 lb. of butter and 2⅕ lb. of cheese from, say, Bega ... | 0·27 „ |
| Total deduction... ... ... ... | 1·02 pence |

This brings the returns for cheese-making down to 11½d. There is, therefore, a gain of ½d. on every 2½ gals. of milk in favour of cheese-making at these prices.

In these calculations the cost of making and selling 2⅕ lb. of cheese is taken as equal to that of making and selling 1 lb. of butter.

Leaving out the questions of relative values of whey and separated milk, there is a gross gain of 2d. per 2½ gals. of milk in favour of cheese. Deducting 1d. for the items abovementioned, we get a difference of 1d. still left in favour of cheese-making. This is what the factory could afford to return the farmer extra by making cheese instead of butter, provided the factory gets 5½d. per lb. for cheese and 10d. per lb. for butter. This comes out at a little less than ½d. per gal. in favour of cheese.

## NOTES AND NEWS.

THE imported Kerry cow "Belvedere Bratha (2,219)," by "Belvedere Black Prince (351)," from "Bratha 2nd (1,617)," put up a big record for a dry season like that we have passed through. Her yield of milk for the season was 834 gallons, with an average test of 4·64 per cent. of butter-fat, or equal to 420 lb. of butter. She yielded 5 gallons of milk per day for some time after calving. The cow is depastured at the Government Stud Farm, Berry, and her milk has been weighed daily. She was giving nearly 2 gallons of milk per day when the farm manager began to dry her off, being near calving. There are three of her progeny on the farm at present—two heifers and a bull—and they look very promising. They were exhibited at Berry Show recently and were much admired by keen judges of dairy cattle.

Two heifers (the property of Mr. Craig, of Jamberoo), by the Government imported Durham bull, "Favourite," from Illawarra cows, were awarded blue ribbons at the recent Wollongong Show. A heifer, of "Favourite's," shown by Mr. Craig, was also second in the milk test prize at last Kiama Show.

---

THE butters that obtained first and second prizes at recent Wollongong Show were made from pasteurised cream. Mr. Foley acted as sole judge.

---

THERE is great demand for the lease of the Government stud bulls at the present time, Durhams, Guernseys, and Holsteins being in most request. There are at least ten applications for every bull of these breeds available for lease.

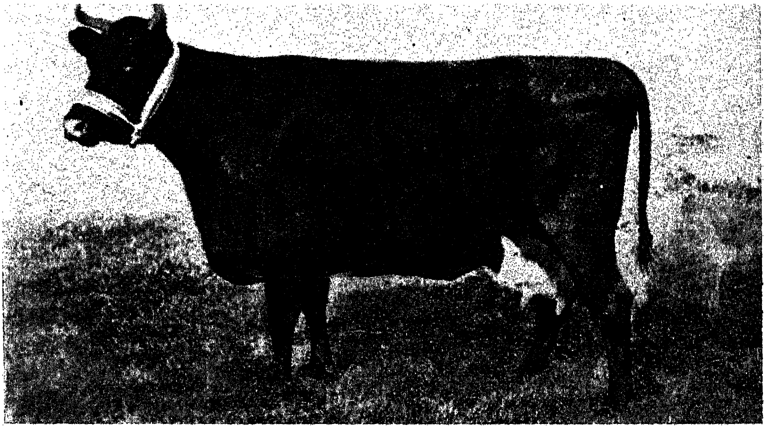
---

A YOUNG bull, by Government stud bull "Cornish Boy" (imp.), from a grade Durham cow, was awarded a blue ribbon at last Tweed Show.

---

THE Government imported Kerry bull, "Kildare," has left some very promising heifers on the Tweed River, and as a consequence "Kildare" is now the most popular Government bull on the Tweed.

THE demand for the service of the Government imported Guernsey bull, "Peter," now at Wollongbar State Farm, has been so great that he ran a risk of being overdone, and several farmers have had to be refused the use of his services.



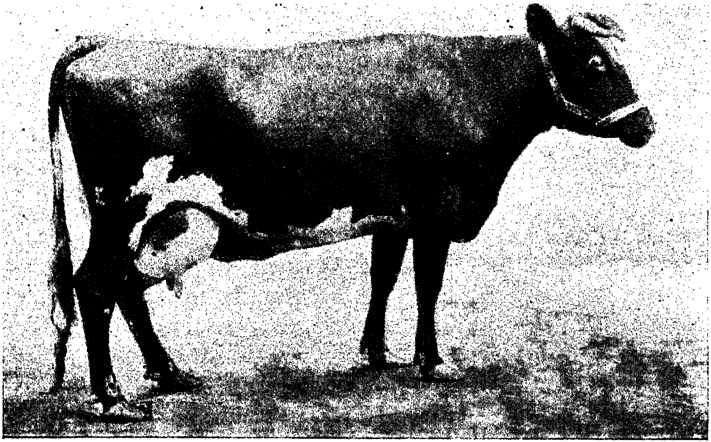
**A typical heavy English Shorthorn, winner of 1st Prize in Dairy Cow Class at Royal Show, Carlisle.**

THE Government imported Jersey bull, "Melbourne," has been leased for six months to Mr. Chilcott, near Singleton. A son of "Melbourne" obtained first prize at last Sydney Royal Show.

THE Government imported Kerry bull, "Aicme Chin," has recently been leased to Mr. Mackenzie, of Stroud, a new dairy district. "Aicme Venus," the mother of "Aicme Chin," was one of the finest types of cows I have seen. She won prizes innumerable, and was a very heavy milker. "Aicme Chin" is a very lengthy level bull and should beget animals suitable for the dairy and for the butcher. This is a great advantage of the Kerry over Jerseys and Ayrshires. Its crosses are noted for beef as well as for milk.

A FACTORY in this State, making 16 tons of butter a week, recently ceased to grade the cream, all of which comes from private separators, because the suppliers objected. They, the farmers, said that it was a co-operative factory, and that all suppliers should get the same price for their cream. This is a new doctrine. It shows where the present system of paying one price for first and second quality butter in Sydney is leading the industry. Many of the dairy farmers of the State are evidently being led to the scene of battle by a guide on friendly terms with the enemy. They do not know the position of things themselves; they do not know of the efforts and methods adopted by other countries to capture the world's butter markets;

they are blinded by past success, and are marching with confidence along a track which will lead them into a position that can only spell *defeat.* The mixing of the good with the bad in industries like butter and cheese making, and brewing where fermentation plays a big part, can only lead to general inferiority. This is where our farmers who compel the mixing of good and bad creams are driving the butter industry. Unless a change is made, and that soon, retribution will come, and come with force. Then the dairy-farmers will be able to recognise their friends, and they will see, when, perhaps, too late, the path which they ought to have taken.



**Shorthorn Cow, "Trefoil," winner of the Spencer Challenge Cup.**

**Shorthorn Cow, "Red Queen," winner of the Barham Challenge Cup in the Milking Trials, London Dairy Show.**

A YOUNG Guernsey bull, by "Rose Prince" (imp.), from "Saucy Sal" (imp.), has been sent to Wollongbar State Farm from the Government Stud Farm at Berry. This young bull will be useful to the farmers of the district to cross on to the heifers they have got by "Peter" (imp.).

THE handsome young Holstein bull, "President," by "Garfield" (imp.), from "Nobeltje 3rd" (imp.), has been leased to the Tweed River Agricultural Society by the Department of Agriculture. "Nobeltje" (imp.), the dam of "President," gave 861 gallons of milk last season, which yielded 354 lb. of butter.

THE young Guernsey bull "Prince Moscow," by "Rose Prince" (imp.) from "Flaxy" (imp.), has been leased for six months to Mr. Ray, of Picton. "Flaxy" is a very handsome cow, and last season gave 644 gallons of milk, which produced 341 lb. of butter. Sires bred like these must, in time, have a most material effect for the better on the dairy cattle of the State.

MILK RECORD of Imported Dairy Stock at Wollongbar Experimental Farm.

| Name of Cow. | Breed. | Age. | Date of Calving. | Period in Milk. | Total Yield of Milk. | Average Test. | Estimated amount Com. Butter. |
|---|---|---|---|---|---|---|---|
| | | years. | | days. | lb. | | lb. |
| Honey 110th ... | Durham... | 8 | 6 Nov., 1901 | 220 | 5,327 | 3·81 | 226·45 |
| Lady Dora ... | ,, ... | 10½ | 5 Aug., 1901 | 275 | 8,406 | 3·69 | 365·40 |
| Souvenir ... | Guernsey | 7½ | 18 Mar., 1901 | 289 | 4,943 | 5·92 | 339·43 |
| Folkje II ... | Holstein.. | 6½ | 27 Oct., 1901 | 276 | 6,464 | 3·43 | 253·60 |
| Margaretha ... | ,, ... | 10 | 25 Oct., 1901 | 329 | 10,904 | 3·28 | 407·83 |
| Miss Douive ... | ,, ... | 3½ | 26 Nov., 1900 | 427 | 6,664 | 3·52 | 272·1 |

THE milk records at Tring Park for the past year show the following averages:—Thirty-one Jersey cows, 630½ gallons; forty-one Red Polls, 638½ gallons; twenty-five Shorthorns, 683½ gallons. The highest yield of all was obtained from a Shorthorn cow, which gave 10,573 lb. These very high averages indicate what careful selection and management can accomplish.

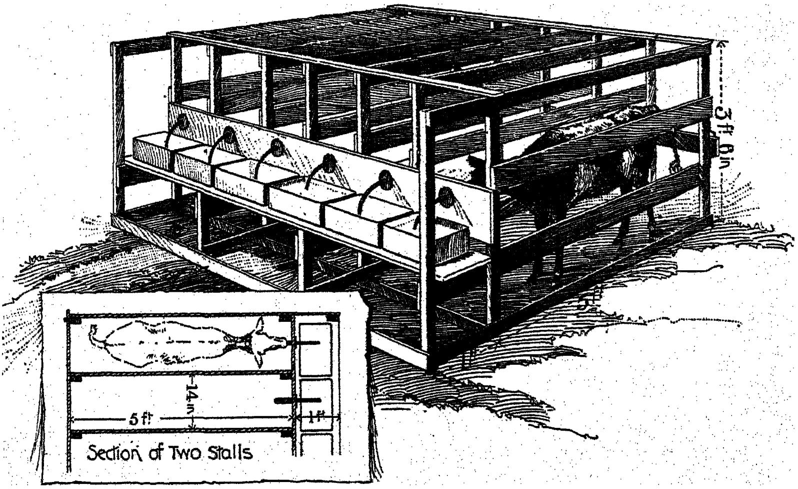
# Calf Stall Feeders.

P. QUIRK.

THE unprecedented drought in the dairy districts has broken up, and it is little use thinking and pondering over the past. Our aim must be to recover lost ground, and build up our herds to the old standard, and, if possible, to a higher state of perfection.

On account of the great loss of stock, it will be necessary for dairy farmers to raise all their calves, to replace those lost, and stock of all descriptions are sure to realise high prices for some years, and thus repay the farmer's labour for the trouble taken.

I give here a sketch of what may be termed stall calf feeders, or feeding pens, which we have used on the Government Stud Farm for two years, and with much success. These pens are constructed of 3 x 1 hardwood battens and 6 x ½ inch lining boards. They are simplicity itself. The length of pens is 5 feet, height 3½ feet, and 15 inches wide. How to construct—say six stalls are required—cut twenty-one boards 5 feet long, and twenty-one battens 3½ feet, then proceed as if you were making a three-batten gate; nail top board flush with batten uprights, then nail bottom board 6 inches from bottom and centre board midway; see that you have it on the square by taking the diagonal line from corner to corner, then nail another 3 x 1 batten upright 11 inches from the front batten, and this hurdle is complete. Continue with the other six in the same way.

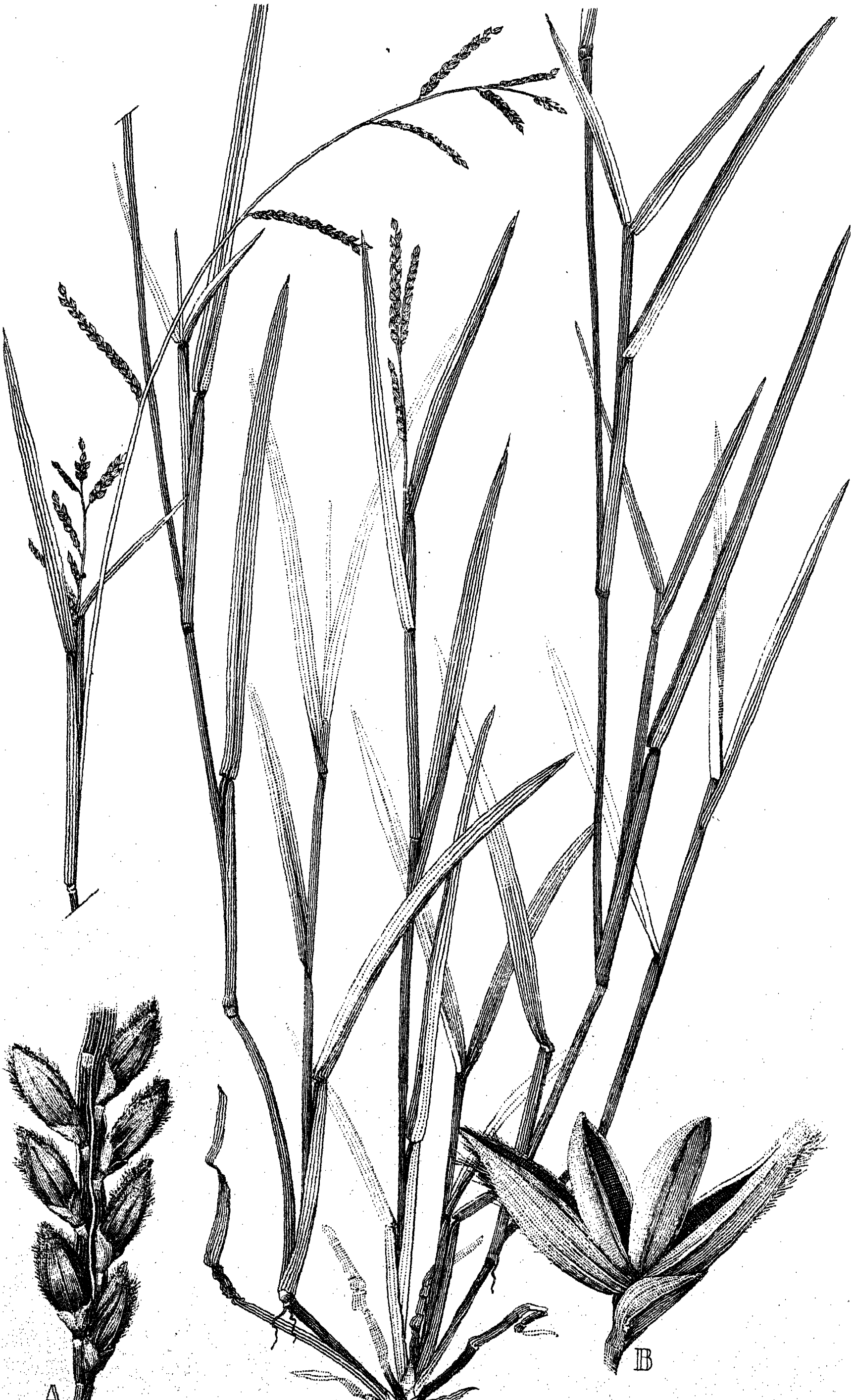


Now cut eight battens 8 feet long; mark four off in 15-inch sections, cut scarfs half through to fit top and bottom of your hurdles, then nail one on top and bottom in front and behind, and your pens are secure; or they may be braced from corner to corner. Next run two battens right through, one behind the front upright, the other in front of second upright, nail 9 inches from the bottom; these are to keep the feed tins in place. Now run a board underneath for tins to rest on, and secure; also run a batten through the pens, and nail to second uprights, 27 inches from the bottom. This bar is over the calves' necks, and prevents them from bumping. Now, to keep the calves secure: Screw to each side and one in the middle, hooks, ⌋, about half the height of the pens; when the calves are in, drop a batten in the hooks and all are secure. I use as feeding vessels kerosene tins cut a little more than half their height, (say) about 8 inches; turn the edges over. I would advise dairy farmers who have trouble in rearing calves to try this simple device. There is no jostling or knocking over the buckets, no beating back the fast drinkers as from a trough, and frightening timid calves; no sucking of the ears. I also notice calves drink more slowly, and do not gulp their food in an unnatural manner. We have had no scouring since using these feeders. Oilcake and meals of all descriptions may be mixed with the milk. The attendant is constantly about the calves, and they get very docile; there is no trouble; remove the bar and they run in after a few turns. Young calves are held securely when fingering is required. Any number of calves may be fed at once, according to the number of pens; all have their allotted share of milk.

When it is necessary to feed a large number of calves, two small drafting yards would be handy, as the fed calves may be turned into the paddock. Hundreds of farmers who have visited the Stud Farm and have seen these feeders, pronounce them a decided success, and invariably ask for a rule to take the measurements, saying, "That is the first thing I'll make when I get home."

## PHYLLOXERA-RESISTANT VINE STOCKS.

THERE are available at the Howlong Viticultural Nursery, rootlings and cuttings of phylloxera-resistant vines for this seasons planting. The varieties and prices at which they can be obtained are enumerated in the Price List accompanying this issue.


A
B

# Useful Australian Plants.

By J. H. MAIDEN,

Government Botanist and Director, Botanic Gardens, Sydney.

## No. 82. *Panicum helopus*, Trin.

*Botanical name.*—*Helopus*, Greek *helos* a swamp, and *pous* a foot, the grass growing in swamps.

*Vernacular name.*—The "Kuri" of India. I know of no Australian name.

*Botanical description* (B.Fl., VII, 476).

*Stems* usually rather tall.

*Leaves* lanceolate, often rather broad and cordate at the base, with loose sheaths, usually more or less hirsute, especially the sheath, but sometimes nearly glabrous.

*Panicle* of few simple branches, sometimes three to five, almost sessile above the last leaf, sometimes six or seven on a rather long peduncle.

*Spikelets* irregularly alternate in two rows along the rachis, or the lower ones clustered and the upper ones more distant, ovoid, acute, nearly 2 lines long, pubescent, villous, or glabrous.

*Outer glume* very short and broad, three-nerved, the second about seven-nerved, the third about the same length, but narrower, five-nerved, with a palea in its axil but no stamens.

*Fruiting glume* minutely rugose, obtuse, but the central nerve produced into a short awn-like point, not exceeding the empty glumes.

*Value as a fodder.*—This is a valuable drought-resisting grass, found in the drier parts of the State. It is a useful, nutritious grass, and Duthie observes that it is an excellent fodder grass for both horses and cattle in India.

*Habitat and range.*—In the interior of this State, and also in South Australia, Queensland, and Northern Australia. Common in tropical Asia and Africa.

### Reference to Plate.

*a*. Portion of flowering spike.

*b*. Spikelet opened out. Note the flowering glume (*a*) without point.

Note.—This form of *Panicum helopus* varies from Trinius' type in the following points:—

1. It is a glabrous form, the outer glumes being alone hairy. It would appear that this species is very variable in this respect.

2. The leaves are narrower. Some Indian forms are much broader leaved.

3. The fruiting glume is not produced into an awn-like short point. This point is often the best diagnostic character in this species. Indian specimens show this awn, and I have a Northern Territory specimen which is intermediate in character between Indian ones and that of our own, which came from Warren, New South Wales.

Bentham's remark that *P. helopus* resembles *Eriochloa* in appearance applies with most appropriateness to our New South Wales plant, and should be borne in mind.

# The Export of Prize Mutton.

## NEW SOUTH WALES SHEEPBREEDERS' ASSOCIATION'S SHOW, JUNE, 1902.

H. V. JACKSON.

THE report has now been received from the Honorable Henry Copeland, Agent-General for New South Wales in London. The prizes offered were partly contributed by the Department of Agriculture of New South Wales. The conditions were as follows:—

> No exhibitor shall compete with more than one exhibit in each class from any one holding.
>
> The exhibitor shall give the age of the sheep, and state their breeding, and if a second cross, the rams used in each cross.
>
> The exhibitor shall state how the sheep have been fed; and if on cultivated food, the kind and quantity should be stated and how long they have been so fed.
>
> The sheep shall be judged alive and in carcase (two sheep from each pen shall be slaughtered on the second day of show and exhibited in pen).
>
> The judges shall take into consideration the quantity and weight of carcase best suited for export; but in case of a tie, then the value of the skin and fat shall be taken to decide the tie.
>
> In case of absolute equality, then the preference to be given to the youngest sheep.
>
> All exhibits considered fit for export shall be killed, frozen, shipped to London, and sold. The net proceeds of sale, after deducting expenses, to be the property of exhibitor.

The competitors were the Hon. R. H. Roberts, Tiverton, Barwang and Currawang; the executors of the late M. Joseph, Maharatta and Mila, Bombala; Chas. B. Grubb, Strathroy, Launceston, Tasmania; owners, Kentucky Station, Corowa; R. L. Gilmour, Blackdown, Bathurst. The judges arrived at their decision by allotting points for the live sheep and afterwards having two average animals from each pen killed and judged in the carcase.

The judges were Messrs. Donald MacKenzie and G. Oldham.

The awards were as follow:—

*The best pen of ten Merino Wethers.*

1st Prize.—Lot 3; pen No. 329. Exhibited by the Executors of the late M. Joseph, Maharatta, Bombala.

2nd Prize.—Lot 4; pen No. 330. Exhibited by the Executors of the late M. Joseph, Mila, Bombala.

3rd Prize.—Lot 5; pen No. 331. Exhibited by Chas. B. Grubb, Strathroy, Launceston, Tasmania.

4th Prize.—Lot 1; pen No. 326. Exhibited by the Hon. R. H. Roberts, Tiverton, Barwang.

*The best pen of ten Cross-bred Wethers.*

1st Prize.—Lot 10; pen No. 336. Exhibited by Owners, Kentucky Station, Corowa.

2nd Prize.—Lot 8; pen No. 334. Exhibited by the Executors of the late M. Joseph, Mila, Bombala.

No prize was given for third and fourth place in this section.

*The best pen of ten Cross-bred Lambs.*

1st Prize.—Lot 11; pen No. 337. Exhibited by the Executors of the late M. Joseph, Maharatta, Bombala.

There was no other entry in this section.

After freezing, the carcases were shipped to London, accompanied by a letter of advice to the Agent-General, who was requested to instruct the London experts to report on the following points:—

1. Neatness of butchering and correctness of dressing for sale.
2. Packing and handling.
3. Suitability for British trade.
4. Comparative value of each lot.
5. Remarks as to difference between such sheep in comparison with sheep from Argentina or New Zealand—in bone, flesh, size, colour, and general quality.

Attention was drawn to the fact that every sheep's carcase was carefully numbered in Sydney, and the Experts were to be requested to make certain they had the properly numbered sheep in each lot put before them. Instructions were also issued that this frozen mutton was to be sold under ordinary circumstances and conditions of the frozen mutton trade.

The survey was made in London by Messrs. Brewster and Frosts and Messrs. Knowles and Perfect, Ltd. Their report was as follows, and for comparison I have attached the Sydney Judges' remarks in each case:—

REPORT of survey on ninety eight carcases of mutton and ten carcases of lamb, ex s.s. "Cuzco," held on Tuesday, 16th September, 1902.

*Question* 1.—Neatness of butchering and correctness of dressing for sale.

Both the neatness of butchering and correctness of dressing are satisfactory through the parcel.—K. and P., Ltd. Butchering and dressing both of sheep and lambs correct.—B. and F.

*Question* 2.—Packing and handling,

Satisfactory.—K. and P., Ltd. Packing and handling satisfactory throughout.—B. and F.

*Question* 3.—Suitability for British trade—Merino wethers.

No. 1.—Poor quality, but suitable for cheap week-end trade; should not be exported in quantities.—K. and P., Ltd. A middling article, only suitable for cheap week-end trade.—B. and F.

The above were from the Hon. R. H. Roberts, Tiverton, Barwang. Bred by exhibitor. Pure Tasmanian, aged 2 and 3 years. The Sydney judge, Mr. G. Oldham, in his remarks said: "Correct weight, but wanting in condition; excellent wool producers, but inclined to be weedy; fourth prize." Mr. Donald MacKenzie said: "These sheep I consider a shade too thin for export." The average killing weight in Sydney was 44 lb. 6 oz.

No. 2.—As No. 1.—K. and P., Ltd. The same as No. 1.—B. and F.

These sheep were exhibited by the Hon. R. H. Roberts, Currawang. Bred by exhibitor. Pure Tasmanian, aged 2 and 3 years. Mr. G. Oldham, in his remarks, said: "Wanting in quality and on the light side; excellent wool producers." Mr. Donald MacKenzie said: "These sheep not quite good enough in condition." The average killing weight in Sydney was 43 lb. 5 oz.

No. 3.—Very suitable sheep and nice handy weights.—K. and P., Ltd. Suitable for British trade; good sheep; very much better than Nos. 1 and 2.—B. and F.

These sheep were exhibited by the executors of the late M. Joseph, Maharatta, Bombala. Pure Burrawang and Wanganella blood, aged 2 years 8 months. Mr. G. Oldham remarked: "First prize; very even and fine wool producers and very fleshy sheep." Mr. D. MacKenzie said: "First prize." The average killing weight in Sydney was 56½ lb.

No. 4.—Ordinary Merino sheep, but not quite as good as No. 3. Very saleable weights.—K. and P., Ltd. Ordinary Merino sheep.—B. and F.

These sheep were exhibited by the executors of the late M. Joseph, Mila, Bombala. Pure Burrawang and Wangamella blood, aged 2 years 8 months. Mr. G. Oldham remarked: "Very even; fine wool producers, and very fleshy sheep. Second prize." Mr. D. MacKenzie said: "Second prize. These sheep are well-woolled and beautiful quality of mutton." The average killing weight in Sydney was 52 lb. 13 oz.

No. 5.—Ordinary Merinos; slightly too heavy; suitable.—K. and P., Ltd. Ordinary Merino sheep. Suitable for the trade.—B. and F.

These sheep were exhibited by Charles B. Grubb, Strathroy, Launceston, Tasmania; bred by exhibitor; full mouth. Mr. G. Oldham remarked: "Third prize. Some of the sheep all that you could desire, but others too fat." Mr. D. MacKenzie said: "I consider one of these sheep splendid quality; the others too fat." The average killing weight in Sydney was 58 lb. 13 oz.

No. 6.—Good quality sheep; suitable.—K. and P., Ltd. Good sheep; very suitable.—B. and F.

These sheep were exhibited by the owners, Kentucky Station, Corowa; bred by exhibitor at station; age, 3 years. Mr. G. Oldham remarked; "Good fleshy mutton for export, but rather too heavy, and too much of the cross to class them as Merinos." Mr. MacKenzie said: "These sheep, I consider, are not pure Merinos, but are good quality." The average killing weight in Sydney was 60 lb.

### *Cross-bred Wethers.*

No. 7.—Good quality sheep, but too heavy, and some too fat.—K. and P., Ltd. Not so suitable for ordinary trade; good sheep, but too heavy.—B. and F.

These sheep were exhibited by the executors of the late M. Joseph, Maharatta, Bombala; Romney Marsh rams; dams, Merino ewes; age, 2 years 8 months. Mr. G. Oldham remarked: "Too heavy for export, and too fat." Mr. D. MacKenzie said: "Too heavy and fat." The average killing weight was 71 lb. 9 oz.

No. 8.—Sheep too heavy; some too fat; and not at all suitable for London trade.—K. and P., Ltd. A shade too heavy; some too fat; not suitable for British trade.—B. and F.

These sheep were exhibited by the executors of the late M. Joseph, Mila; bred by exhibitor; Romney Marsh rams; dams, Merino ewes; aged 2 years 8 months. Mr. G. Oldham, in his remarks, said: "Second prize; rather too heavy, and a little too fat." Mr. MacKenzie said: "Second prize; I consider these sheep are rather too heavy, and a little too fat." The average killing weight was 68 lb. 9 oz.

No. 9.—Not suitable; too heavy.—K. and P., Ltd. Some too leggy, too heavy, and not suitable.—B. and F.

These sheep were exhibited by Mr. R. L. Gilmour, Blackdown, Bathurst; bred by exhibitor; sires, Shropshire rams; dams, Lincoln Merino ewes; aged 2 years 10 months. Mr. G. Oldham remarked: "Too heavy and too fat." Mr. Mackenzie said: "Too heavy and fat." The average killing weight was 68 lb.

No. 10.—The best heavy sheep in the whole parcel, and very suitable for British trade; a very even lot of sheep.—K. and P., Ltd. Very nice sheep; by far the best heavy sheep in the whole parcel; suitable for British trade; very even sheep; quality very good, but weight is rather against them.—B. and F.

These sheep were exhibited by the owners of Kentucky station, Corowa; bred by exhibitors; sires, Lincoln rams; dams, Lincoln Merino ewes; four-tooth. Mr. G. Oldham remarked: "First prize; very suitable for export; weight right." Mr. MacKenzie said: "First prize; these sheep I consider very nice quality." The average killing weight was 65 lb. 7 oz.

### *Cross-bred Lambs.*

No. 11.—Very suitable good bred lambs, and nice quality.—K. and P., Ltd. Very suitable for British trade; well-bred lambs and good quality—B. and F.

These lambs were exhibited by the executors of the late M. Joseph, Maharatta, Bombala. Mr. G. Oldham remarked: "First prize; most suitable for export, and quite worthy of the first prize." Mr. D. MacKenzie said: "First prize; I consider these very suitable." The average killing weight was 35 lb. 9 oz. Bred by exhibitors; sires, Romney Marsh rams; dams, Comeback ewes; age, 5 to 5½ months.

*Question* 4.—Comparative value of each lot; Order of merit.

| | | s. | d. | | | s. | d. |
|---|---|---|---|---|---|---|---|
| No. 10 | 100% | 2 | 3½ | No. 5 | 35% | 2 | 2 |
| No. 3 | 100% | 2 | 3 | No. 7 | 25% | 2 | 3 |
| No. 6 | 70% | 2 | 3 | | 75% | 2 | 2½ |
| | 30% | 2 | 2½ | No. 8 | ...... | | ...... |
| No. 4 | 65% | 2 | 3 | No. 9 | ...... | | ...... |
| | 35% | 2 | 2½ | No. 1 | 80% | 2 | 2 |
| No. 5 | 65% | 2 | 3 | No. 2 | 20% | 2 | 1 |

K. and P., Ltd.
B. and F.

No. 11.—The market value of Australian lambs such as these would be from 2s. 10d. to 3s. [*Note.*—The account sale price is no guide for the ordinary wholesale trade, the quantity in each parcel being too small in number. The prices quoted above are based on the current market price on the day of survey, and for a line of not less than 100 carcases.]—K. and P., Ltd. B. and F.

*Question* 5.—Remarks as to difference between such sheep in comparison with sheep from Argentina or New Zealand in bone, flesh, size, colour, and general quality.

Nos. 1 and 2 are equal to small plain Plate sheep in bone, flesh, size, and quality. The remaining parcels are quite equal to, and compare very favourably with Plates. The whole parcel has not, however, the bright appearance of Plate sheep; consequently, would not demand such a ready sale. There is no comparison between these and New Zealand sheep.—K. and P., Ltd. B. and F.

BREWSTER AND FROSTS (*per* H. RAWSON).
KNOWLES AND PERFECT, LTD. (*per* H. W. PALFREY).

*Note.*—The above report appears to be sufficiently clear to not necessitate further remarks, beyond the fact that it is satisfactory to note that the judging in Sydney has been confirmed by the experts in London. The following statement of account sales has been prepared by Mr. E. D. Butler, of the Account Branch, Department of Mines and Agriculture.

| Account Sales. | | | | | | | | | | | | Charges. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catalogue No. | Shipping No. | Names. | Class. | No. of Carcases and London weights. | Rate per stone. | Amount. | Weight of Skins. | Rate. | Amount. | Sale of Fat, Tongues, &c. | Total Gross Returns. | Charge for Slaughtering, Freezing, and Shipping. | London Charges. | Selling Charge on Skins. | Total Charges. | Total Net Returns. |
| | | | | st. lb. | s. d. | £ s. d. | lb. | d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | s. d. | £ s. d. | £ s. d. |
| 325 | 1 | Roberts, Hon. R. H. .... | Merino........ | 10=53 2 | 2 2 | 5 15 4 | 146 | 7 | 4 5 2 | 0 15 4 | 10 15 10 | 3 2 0 | 1 9 2 | 3 5 | 4 14 7 | 6 1 3 |
| 327 | 2 | Do .... | do ........ | 10=52 0 | 2 2 | 5 12 8 | 152 | 7 | 4 8 8 | 0 15 4 | 10 16 8 | 2 12 3 | 1 18 11 | 3 6 | 4 14 8 | 6 2 0 |
| 329 | 3 | Joseph, Exrs. of the late M. | do ........ | 10=68 2 | 2 3 | 7 13 7 | 143 | 7 | 4 3 5 | 3 16 10 | 60 16 1 | 13 1 3 | 9 14 10 | 13 0 | 23 9 1 | 37 7 0 |
| 330 | 4 | Do .. | do ........ | 10=64 5 | 2 3 | 7 5 5 | 139 | 7 | 4 1 1 | | | | | | | |
| 333 | 7 | Do .. | Cross-bred wethers. | 10=87 0 | 2 3 | 9 15 9 | 122 | 6¾ | 3 8 7 | | | | | | | |
| 334 | 8 | Do .. | do .. | 10=83 2 | 2 3 | 9 7 3 | 117 | 6¾ | 3 5 10 | | | | | | | |
| 337 | 11 | Do .. | Cross-bred lambs. | 10=42 6 | 3 1 | 6 11 10 | 67 | 4¾ | 1 6 6 | | | | | | | |
| 331 | 5 | Grubb, Chas. B. ...... | Merino........ | 10=70 1 | 2 3 | 7 17 9 | 116 | 7 | 3 7 8 | 0 15 4 | 12 0 9 | 2 12 2 | 1 18 11 | 2 9 | 4 13 10 | 7 6 11 |
| 332 | 6 | Owners, Kentucky Station | do ........ | 10=72 5 | 2 3 | 8 3 5 | 8=104<br>2= 26 | 6¾<br>7 | 2 18 6<br>0 15 2 | 1 9 2 | 23 4 1 | 4 16 9 | 3 10 1 | 5 2 | 8 12 0 | 14 12 1 |
| 336 | 10 | Do .. | Cross-bred wethers. | 5=39 4<br>3=23 1 | 2 4<br>2 3 | 4 12 2<br>2 12 0 | 9=112 | 5¾ | 2 13 8 | | | | | | | |
| 335 | 9 | Gilmour, R. L. .......... | do .. | 10=82 0 | 2 3 | 9 4 6 | 85 | 5¾ | 2 0 9 | 0 15 5 | 12 0 8 | 2 12 3 | 1 19 0 | 1 7 | 4 12 10 | 7 7 10 |

# Bee Matters.

ALBERT GALE.

Some years ago I made it my business to inquire of every bee-keeper I met as to what conditions of season were most favourable to the production of honey. The answers received may be summed up thus: a dry summer following a wet spring will be sure to be followed by a good flow of honey. In some parts of this State these are the conditions now prevailing, and at present in the coastal districts, especially so around about Sydney, some of the indigenous timber trees have produced abundance of bloom, and honey is coming in plentifully. This outburst of bloom is now being followed by the bees breeding *pro ratio*, and this is being followed by abnormal swarming. In my own little experimental apiary six hives threw off thirteen colonies before Christmas. Seven of these I removed to the Hawkesbury Agricultural College apiary. These have thrown off seven maiden swarms, as did also one other, being an increase of upwards of twenty colonies from my half-dozen. Of course this season bees will be of far more importance than honey—that is, from a bee-keeper's standpoint. If the flow of honey from our native apple-trees is followed up by other native honey-yielding trees coming into bloom, the bees will be sure to make hay while the sun shines, and in this way slightly make up for the time lost in the past season. In 1892 one bee-keeper informed me that the kind of season he most gloried in was a wet autumn, dry winter, showery spring, followed by a dry summer. This kind of weather, he said, produced the greatest yield of honey he had ever known. Will such seasons follow this drought? If so, there is yet hope for the bee-keepers. Undoubtedly the present favourable conditions will go a long way towards building up the decimated bees, thus preparing a foundation for good honey seasons that may confidently be expected to follow the breaking up of the drought. To this end bee-keepers, both amateur and professional, would do well to sacrifice honey to the production of bees, for undoubtedly they will be required in the near future.

## The Care of New Swarms.

One of the most, if indeed it is not *the most*, interesting episodes with all bee-keepers, is the swarming season. No matter whether he is a well-seasoned practical apiarist, or one only trying his apprentice hand with a view to becoming a professional bee-keeper, or merely a "hobbyist," it makes little difference. Swarming is as natural an instinct in bees as broodiness is in hens. A hen sits to complete the reproduction of her species, and bees swarm for the same purpose. Where bee-keeping is carried on for a hobby, or where the bee-keeper is only a beginner, there is always feverish anxiety to catch the early spring swarms. The inquiry made of men with more experience than themselves is—When do you think my bees will swarm? It is much easier to ask that question than to answer it. There are so many contingencies and side issues thereto, all of which must be taken into the consideration even of the most experienced among bee-men. To catalogue them is a task that few would undertake without misgiving. The circumstantial catalogue of last season would not apply to this, and this season may not apply to next. But, given that the bees have been well wintered, that they have come through the cold season physically and numerically strong, that they are descendants from ancestors whose chief trait is industry (there is as much difference in the industrial habits of bees as there is amongst men), that spring arrives with an abundance of pollen and honey-bearing flowers, then, and not till then, may the bee-keeper expect his first and earliest swarms. It is the *early* swarms that are most interesting from other points than that of profit. "When my bees swarm forth, where will they alight?" is another question that the experienced man is likely to answer with, "Oh, give us something easy?" Nevertheless there are one or two moral certainties in connection with the question. It will be somewhere near the hive they issued from, and not too high for easy capture—*i.e.*, if it be the first swarm of the season. The reason is that the *first* swarm is accompanied by the old laying queen. She is in a condition that makes her too heavy to travel too far from home in one flight. Nevertheless as soon as the swarm has fairly settled it should be at once captured. How are you to do it?

Well, that is an easier question to answer than the former one. Bees when swarming always put on their very best behaviour; but you must bear in mind bees sometimes take very strange fancies. If the bees have settled on a bough, roll up your sleeves—you are safer that way; take a candle-box or something equally light, and shake the bees into it, and place it on the ground, seeing that the bees have easy access to the interior. What is the next step? Of course you have already got your hive in position, with a sufficiency of frames with starters attached. If such be the case, commence the transference of the swarm from the candle-box to their permanent abode as soon as possible. It is not necessary to wait until sundown, or until every bee has settled in the box. The few bees that may be unwilling to settle will either follow the swarm or return to the parent hive.

The transfer may be effected either by shaking the swarm down on the frames of the new hive—the cover and quilt having been removed—or if the hive be on the ground, by tumbling the bees out in front of the entrance. I prefer the first-mentioned method. In either case, it will not be long before the bees enter; but we cannot always be certain that the swarm which enters the new home ever so docilely will be satisfied with it and remain. Sometimes a swarm will appear to be quite at home for a day or two; then, without a minute's warning, off they go. This annoying trait is peculiar to some families of bees, and it is not easy to control. One of the means of making certain of their remaining in the new hive is to place therein a frame of young brood of eggs from the parent stock. The method has the disadvantage of weakening the colony from which the frame is taken, but is generally quite effectual.

In placing hives on stands or on the ground, be sure to have the place perfectly level, so that the frames will hang plumb. Great care should also be taken to correctly and evenly space the frames.

I have been asked whether I believe in artificial swarming. Yes; that is the practice known among practical apiarists as dividing swarms. It is a very good thing, especially if, during the swarming season, there is no one about to watch the swarms.

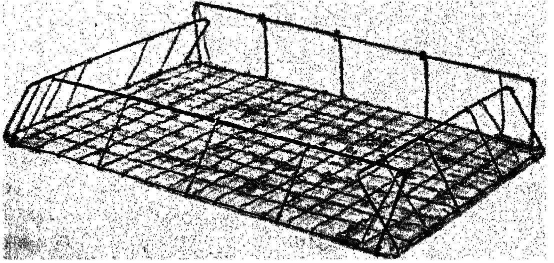
Another correspondent asks whether the clipping of the wings of the queen bee is to be recommended. This practice is advisable, if you live in closely-settled suburbs and may have to get over other people's fences in search of errant swarms; otherwise there is not much in it. As I have already pointed out, the laying queen which generally accompanies the first swarm cannot fly far, although she can fly well enough to cross a fence, and under the circumstances, the clipping of one of her wings would probably save some inconvenience; but in the case of virgin queens, which accompany the after swarms, the operation would be rather difficult, and one must be always prepared for a rather merry dance after such queens.

## BEE APPLIANCES—WIRE SECTION-CRADLES.

THERE are some people who object to honey, not because they dislike it as a food, but liquid honey, they say, has a tendency to become daubed on whatever it touches. Nevertheless, this is not a true bill against the use of honey, for the same may be said of jam and other similar foods. Many who object to take liquid honey are passionately fond of honey in the comb. Of all forms of honey in the comb, none is so attractive as that in those small one-pound sections. A section of honey in virgin comb, which, as a rule, is beautiful and white, is at once attractive to the eye and tempting to the appetite. Beyond this, section honey is at once well-shaped and a convenient size for table purposes. If it be carefully removed from the section frame in which it was stored, little or no honey will escape from the cells. It can be placed on the table without appearing, as is sometimes the case, to float in liquid honey. I have sat at a table where beautiful sections of honey have confronted me, and beside it a *blunt* silver butter-knife. I have seen persons take this rude instrument (rude for honey purposes), thrust the point of it into the honey, and take as much as they require; but in the comb left behind the cells are broken and torn, and the honey that escapes from the portion removed dribbles over the surface of the comb left behind. Honey sent to table in the comb should be kept as free from the liquid as possible. To do this it is only necessary to use a sharp steel knife and a little care, and that object will be accomplished.

It was this desire for honey in the comb that caused shallow frames to come into use, and the beautifully white section frames were evolved for the same purpose. I know, from a marketable point of view, they are not so profitable as the production of liquid honey; but where people keep bees for their own domestic purpose this will not be taken into account. All wooden section-holders, to my mind, are more or less cumbersome and inconvenient to manipulate, and always a source of additional labour to the bees. It gives additional work to the bees, in that the wooden section-cradles or holders are so constructed that there are interstices that cannot be avoided. Indeed it is inadvisable to construct all the fittings within a section super to fit like the proverbial glove; if so, the whole thing would be unworkable, especially after they had been in use for a few seasons, *i.e.*, if they were not always "kept as clean as a new pin." It is well known that bees object to too much or too little space. The former they will contract to ordinary "bee-space"; the latter they will close up altogether, in each case using for the purpose propolis (bee-glue). The gathering of this latter material is profitless work, as the material used enters in no way into the economy of the hive except for the purposes named. (If space permitted I would modify this latter statement.)

An eight-frame shallow is so constructed so as to receive six section-holders. Each of these will hold four sections, thus twenty-four sections are the full complement for an eight-frame hive. To fit up a shallow super with sections will require six handlings, once for each holder; all this in addition to the adjusting and tightening with bits of wood, wedges, or screws, &c., so as to leave as few interstices and have the whole as complete and as compact as possible. The reason is, that thus put together, it is a great saving to the bees in labour. When the sections are full of capped honey (*i.e.*, with the comb sealed), all this unscrewing, removing of wedges or adjusters, must be gone through, and after the bee-glue has been removed from the section-holders, the whole process of putting them together and adjusting must be gone over anew. "Labour saved is money earned" is a wise old saw. Do these wire section-cradles save labour? Yes! both to the bee-keeper and to the bees. How? In this way: The wire section-cradle is placed immediately on the top bar of the brood-frames, even before placing the shallow super in position. The supers without the rebate are the ones I use. I also remove the strips of tin on which the wooden section-holders rest. For the information of bee-keepers who have not seen them, I now

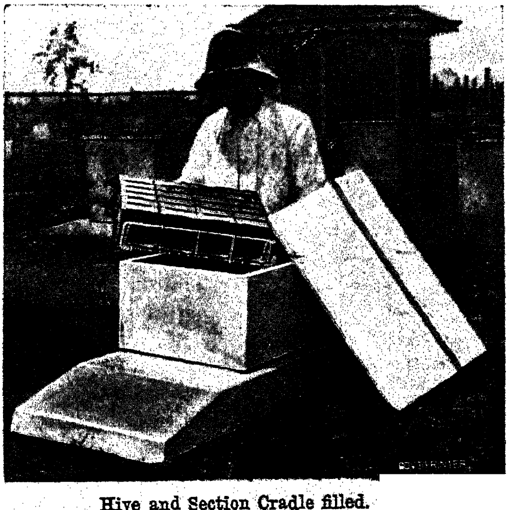


Section Cradle.

reproduce illustrations of these wire-cradles. In these it will be observed that one side and one end-piece of the cradle are fixtures, whilst the other side and end are hinged with rather strong spiral springs attached similar to bird-cage wire doors. I have them in use with four spring sides, and also some without any spring sides—*i.e.*, the four sides are fixtures. I find those with one end and side a fixture, and the remaining end and side hinged and fitted with bird-cage spiral spring. The springs require to be sufficiently strong to grip the sections and separators firmly enough to keep them in position. For separators I use queen-excluding zinc. I find these far superior to those post and rail separators that were introduced about two years ago from America.

As to cost, I think they are rather expensive. I gave 2s. 6d. each for those I experimented with, but then, they were only trial samples. If made in quantities they could, I should think, be made more cheaply.

I have had them in use now for three years, and their advantages are in every way far above any and every kind that have hitherto been used. However, that is my verdict, and I know of no kind of section-holder, sections, or supers but what I have or have had in use. In fitting them with sections they are simplicity itself; they are as easily manipulated as it is to remove a cover from a hive; and they are always clean—*i.e.*, free from bee-glue. When the cover of the hive and the shallow super are removed, these wire section-cradles will remain on the top bars of the brood-chamber, and the whole of the sections are fully exposed to view. By pressing open the spring side or end, any section can be removed and another substituted without removing the cradle. These are surely advantages worth trying.



Hive and Section Cradle filled.

## DEVON CATTLE.

THE Department of Agriculture is in receipt, through the Agent-General in London, of a number of copies of a pamphlet referring to Devon breed of cattle, published by the Devon Cattle Breeders' Society, Wiveliscombe, Somerset, England.

# Manures for Passion Vines.

TOWARDS the end of 1901, discussion arose in the Glenorie Progress Association as to the monetary value of commercial manures and their relative value to fruit-growers. Just about that time the "spot" was very bad on the passion vines and fruit, and greatly distressed growers. Dr. Cobb and Mr. Allen gave the opinions which appeared in the *Agricultural Gazette* for March and April, 1902. Growers began to ask themselves the question whether they were on the right track as regards manuring passion vines, and the Department of Agriculture was requested to assist the growers by carrying out various experiments with commercial manures. The Department having consented to do so, Mr. Allen, Fruit Expert, visited the Glenorie district and chose four orchards within a radius of 3 miles, no two soils being exactly alike. The description of the soils is as follows:—

Mr. Arnold's.—Chocolate loose loam.
Mr. Dale's.—Shaley loamy clay.
Mr. King's.—Black soil and a loamy soil.
Mr. Taylor's.—A very loose sandy and gravelly loam.

The distance apart of the vines in each case is:—

Mr. Arnold's.—14 x 14 feet.
Mr. Dale's.—16 x 10 feet.
Mr. King's.—18 x 12 feet.
Mr. Taylor's.—12 x 12 feet.

The manures of every kind were carefully weighed and thoroughly mixed together before spreading, and the application, which commenced on Mr. King's orchard on 5th November, 1901, was done under most favourable conditions. Immediately after spreading, the manures were harrowed and ploughed in, and during the very dry season the scarifier was kept going periodically. The rainfall was a very light one indeed, the season being the driest known to the oldest growers, and, therefore, in the opinion of the Association, not a fair test to go by. The above particulars are contained in a report by Mr. John Taylor, Secretary to the Glenorie Progress Association.

On the 11th October, 1902, Mr. Taylor reported:—"The welcome rains which have just fallen are the best we have had for two years. I have visited the orchards of Messrs. Dale and King, and find that the results have been better with Mr. King than with Mr. Dale, while, in the younger plantation of Mr. Taylor, the best results are noticeable.

"The commercial manures used were based by the Chemist, Mr. F. B. Guthrie, on the assumption that the bearing passion-vine removes from the soil (in a year) about

6¼ oz. nitrogen,
1¼ oz. phosphoric acid,
4 oz. potash,

as determined by analysis, and costing between 4d. and 5d. per vine.

The complete list was as follows :—

*Single Manures and Complete Manures.*

1. No manure.
2. 32 oz. sulphate of ammonia.
3. 52 oz. dried blood.
4. 43 oz. nitrate of soda.
5. 9 oz. superphosphate.
6. 9 oz. Thomas phosphate.
7. 8 oz. bone-dust (20 % $P_2O_5$).
8. 4 oz. rock phosphate (80 % phosphate).
9. 8oz. sulphate of potash.
10. 6½ oz. chloride of potash.
11. 32 oz. sulphate of ammonia.
    9 oz. superphosphate.
12. 32 oz. sulphate of ammonia.
    8 oz. sulphate of potash.
13. 9 oz. superphosphate.
    8 oz. Sulphate of potash.

*Complete Manures, using different forms of ingredients in the same proportion.*

14. 32 oz. sulphate of ammonia.
    9 oz. superphosphate.
    8 oz. sulphate of potash.
15. 52 oz. dried blood.
    9 oz. superphosphate.
    8 oz. sulphate of potash.
16. 43 oz. nitrate of soda.
    9 oz. superphosphate.
    8 oz. sulphate of potash.
17. 16 oz. bone-dust.
    40 oz. nitrate of soda.
    8 oz. sulphate of potash.
18. 43 oz. nitrate of soda.
    9 oz. Thomas phosphate.
    8 oz. sulphate of potash.
19. 16 oz. bone-dust.
    28 oz. sulphate of ammonia.
    8 oz. sulphate of potash.
20. 32 oz. sulphate of ammonia.
    9 oz. superphosphate.
    6½ oz. potassium chloride.
21. 52 oz. dried blood.
    9 oz. superphosphate.
    6½ oz. potassium chloride.
22. 43 oz. nitrate of soda.
    9 oz. superphosphate.
    6½ oz. potassium chloride.
23. 40 oz. "Nipho."
    24 oz Sugar Company's "A" manure.
    16 oz. Australian potash.
    } Mr. D. Scott's mixture.

*Mixed soluble and insoluble Fertilisers.*

24. 16 oz. sulphate of ammonia.
    26 oz. dried blood.
    9 oz. superphosphate.
    8 oz. sulphate of potash.
25. 16 oz. sulphate of ammonia.
    26 oz. dried blood.
    4½ oz. superphosphate.
    2 oz. rock phosphate (80 %).
    8 oz. sulphate of potash.

*Mixed soluble and insoluble Fertilisers*—continued.

26. 21 oz. nitrate of soda.
    26 oz. dried blood.
    9 oz. superphosphate.
    8 oz. sulphate of potash.
27. 21 oz. nitrate of soda.
    26 oz. dried blood.
    4½ oz. superphosphate.
    2 oz. rock phosphate (80 %).
    8 oz. sulphate of potash.
28. 21 oz. nitrate of soda.
    26 oz. dried blood.
    4½ oz. Thomas phosphate.
    4½ oz. rock phosphate.
    8 oz. sulphate of potash.

*Insoluble Manures at Planting—Soluble Manures as top dressing at intervals.*

29. 26 oz. dried blood.
    16 oz. bone-dust.
    2 oz. sulphate of potash.
    Top-dressing—
    16 oz. sulphate of ammonia.
    4½ oz. superphosphate.
    6 oz. sulphate of potash.
30. 21 oz. nitrate of soda.
    4½ oz. Thomas phosphate.
    2 oz. sulphate of potash.
    Top-dressing—
    22 oz. nitrate of soda.
    4½ oz. superphosphate.
    6 oz. sulphate of potash.
31. 26 oz. dried blood.
    2 oz. rock phosphate (80 %).
    2 oz. sulphate of potash.
    Top-dressing—
    16 oz. sulphate of ammonia.
    4½ oz. superphosphate.
    6 oz. sulphate of potash.
32. 32 oz. bone-dust.
    Top-dressing—
    28 oz. sulphate of ammonia.
    8 oz. sulphate of potash.
33. 9 oz. Thomas phosphate.
    Top-dressing—
    32 oz. sulphate of ammonia.
    9 oz. superphosphate.
    8 oz sulphate of potash.
34 26 oz. dried blood.
    16 oz. bone-dust.
    2 oz. sulphate of potash.
    Top-dressing—
    24 oz. sulphate of ammonia.
    6½ oz. superphosphate.
    8 oz. sulphate of potash.
35. No manure.
    Top-dressing—
    32 oz. sulphate of ammonia.
    9 oz. superphosphate.
    8 oz. sulphate of potash.
36. No manure.
    Top-dressing—
    43 oz. nitrate of soda.
    9 oz. superphosphate.
    8 oz. sulphate of potash.

*Different proportions of the Ingredients.*

37. 16 oz. sulphate of ammonia.
9 oz. superphosphate.
8 oz. sulphate of potash.
38. 64 oz. sulphate of ammonia.
9 oz. superphosphate.
8 oz. sulphate of potash.
39. 32 oz. sulphate of ammonia.
18 oz. superphosphate.
8 oz. sulphate of potash.
40. 32 oz. sulphate of ammonia.
9 oz. superphosphate.
4 oz. sulphate of potash.
41. 32 oz. sulphate of ammonia.
9 oz. superphosphate.
16 oz. sulphate of potash.
42. 64 oz. sulphate of ammonia.
18 oz. superphosphate.
16 oz. sulphate of potash.

"Complete manures in every instance showed themselves far more preferable than single manures, and the following were the best used :—

"No. 21.—52 oz. dried blood,
9 oz. superphosphate,
6½ oz. potassium chloride.

"No. 23.—40 oz., nipho.
24 oz. Sugar Co.'s 'A' manure.
16 oz. Australian potash.

"No. 22.—43 oz. nitrate of soda.
9 oz. superphosphate.
6½ oz. potassium chloride.

"No. 39.—32 oz. sulphate of ammonia.
18 oz. superphosphate.
8 oz. sulphate of potash.

"This last mixture answers well for the very dry season we have experienced, and is the best for summer dressing. These manures are the best so far used, and side by side with the single manures the comparison is very marked ; and as regards the rows left between, and which received no manure, they look half starved and in a hang-fire condition when compared with the vigorous growth of the well-fed vine carrying a crop of well-developed fruit,—clearly proving that commercial manures will pay when we can arrive at the exact requirements of the various soils. It was strikingly apparent in these tests that the results in no two cases were exactly alike, the manure in each class of soil producing difference in growth, &c., more or less slight, but nevertheless noticeable."

To this report, the Fruit Expert, Mr. Allen, adds : "So far as the experiments go, it is clear that on the soils on which they are being conducted it is absolutely necessary to manure if anything like good returns are to be expected. The manured vines are so far ahead of those untreated that, generally speaking, there is no comparison between them, and while the manured vines are in good condition after carrying their last year's crop of fruit, and promise well for the coming season, the unmanured vines appear to have become exhausted and look as if they had little vitality left for the approaching season. In my opinion, passion-vine growers cannot afford to allow a season to pass without assisting the vines by the application of some manure, and, so far as the present experiments enable me to judge, the complete manures undoubtedly give the best results."

The Chemist, Mr. F. B. Guthrie, reports: "I visited the orchards in which the experiments are being carried out, with Mr. Allen, in November. The results were striking, and the differences between the manured and unmanured vines very marked. The experiment is being watched keenly by the orchardists in the district, and provides an invaluable object lesson as to the efficacy of manuring. I arranged with Mr. Allen for a further set of experiments for this season, to test particularly those mixtures which are giving the best results. These are so arranged that the crop for each row can be picked and packed separately, so that the actual money-return from the use of the different manures can be ascertained."

The Hon. the Minister for Agriculture having approved of the experiments being extended over another season, Messrs Allen and Guthrie arranged for the necessary manures, and the mixtures were applied during the last week in November last. On Mr. John Taylor's vines the same mixtures were applied on the same vines as were done in 1901. In addition to these, however, the mixtures 20, 21, 24 were each applied to sixty vines. These were some of the mixtures which were considered to have shown the best results in the previous season's manuring.

On Mr. King's vines, only three mixtures were used this time—Nos. 21, 22, and 24—and with each manure sixty passion-vines were treated. In 1901 manures were applied to certain vines in a second plantation of Mr. Taylor's, but it was not deemed advisable to continue the application, as the vines are very old and results arising from their treatment would not be of much general application.

At Mr. Dale's place, sixty-nine vines were treated with mixtures 20 and 21, and fifty-four vines with No. 26.

As Mr. Arnold was unable to personally supervise the experiments at his place, it was decided not to apply manure there this season.

Messrs. Taylor, Dale, and King will keep a record of the quantity of fruit taken from each of their plots of sixty vines to which the manures were applied, so that there will be available reliable figures for future guidance. Mr. Taylor will also keep a record of the quantity of fruit taken from six of his best plots of nine vines, which will be determined by independent inspections.

THE belief among some people that the shape of an egg determines the sex of the chick is without any foundation. The prevailing idea among such people is that the long eggs produced the cockerels, and the round eggs the pullets. But many hens lay eggs very uniform in shape, some a round egg and some a long one, and from each kind are produced both cockerels and pullets. We do not believe that any person can foretell the sex of a chick from the appearance of the egg. It keeps its own secret, and the poultryman must be satisfied with what it may give him.—*Exchange.*

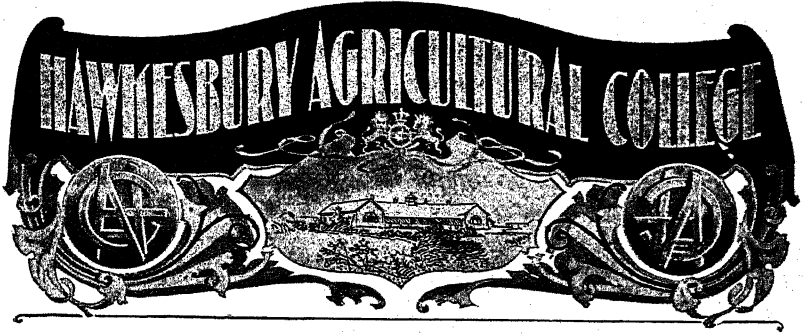
# MAKING UNFERMENTED WINE.

IN reply to a correspondent who asks for information as to the making of unfermented wine in small quantities and without expensive appliances, the Viticulturist reports :—

Clean grapes are picked when not over-ripe, and are crushed immediately after. The juice is run into a cauldron and heated until the temperature, taken with a reliable thermometer, rises to between 167° and 176° Fahr. The temperature of the bulk should be taken by immersing the bulb of the thermometer in different parts of the cauldron—near the bottom, near the surface, and near the sides. The thermometer is kept for fifteen seconds in the must, then is quietly extracted and quickly read. As soon as the temperature of between 167° and 176° Fah. is reached in the bulk of the juice throughout, the cauldron is removed from the fire and the juice is allowed to cool down and settle all the solid substances. The cleared liquor should then be filtered. A good filter for the purpose is a woollen one of conical shape. Such filters are to be had at Messrs. Elliott Bros., Sydney, and perhaps elsewhere, for about 7s. 6d. each. Prior to use, the filter should be kept soaking in a solution of ½ lb. caustic soda to 4 gallons water for twenty-four to forty-eight hours, then rinsed several times in fresh water. In pouring the must from the cauldron into the filter, the sediment should not be disturbed, lest it should clog the pores of the filter. If a filter is not available, the juice may be bottled direct from the vessel in which it has been allowed to settle. In bottling, a clean india-rubber syphon should be used. To make sure of its cleanliness, it should be kept for twenty-four hours in caustic solution, prepared as mentioned above for the filter, then rinsed in fresh water.

The bottles before filling should be washed and rinsed like the syphon, and the corks boiled in water for about ten minutes. The bottles must not be filled so that after being corked the juice is in contact with the cork, but half-an-inch air-space should be left, and the cork tied down with twine. This done, the final pasteurising is necessary. As many such bottles as the cauldron will hold are placed in it in a vertical position. Water is poured into the cauldron so as to have 2 or 3 inches of water above the necks of the bottles. As soon as the water reaches boiling point the fire is withdrawn and the bottles allowed to cool, then removed and laid *on their side* in a cool place. When a bottle is opened for use, whatever juice is left will keep for a long time, provided that a clean cork, which has just been boiled, is used. The recorking must be done without delay, and no bottle should be left open for longer than is necessary to remove some of the contents.

The success of this process depends mainly on the cleanliness of the vessels and other appliances used, and on the careful control of the temperature at which yeast and mould germs are killed.



# HAWKESBURY AGRICULTURAL COLLEGE AND *EXPERIMENTAL FARM.*

## THE USE OF PLANTS FOR CHECKING WATER EVAPORATION.

C. T. MUSSON.

IN a Sydney paper there appeared a letter (dated 23 December, 1902) on the above subject by Mr. Fred. Turner, in which he points out that the Public Works Department is carrying out experiments with the view of endeavouring to check the evaporation of water from inland reservoirs. In the hot, dry, districts, any means for lessening the evaporation that goes on would be of great benefit.

Amongst the plants named as probably useful for the purpose are the water fern, or red jacket (*Azolla rubra* and *A. pinnata*), mentioned as having, within the experience of the writer, acted beneficially in the direction indicated. Opinions of experienced residents are also quoted to the same end.

The whole subject is one of considerable interest, especially to such as find a difficulty in preserving their water supplies when in open tanks from the enormous evaporation. Here, at Richmond, the amount of water lost yearly from a water surface was 47¼ inches in 1902, the annual rainfall for same period being 19½ inches. In the dry interior the evaporation from any open tank may be anything between 50 and 65 inches per annum. The larger the surface exposed the greater the amount evaporated, for the more readily can the wind sweep over its surface. The amount of evaporation is controlled mainly by the amount of wind. Here, on a day registering 100° Fah., with moderate wind, the loss would only be from ⅕ to ¼ of an inch in the twenty-four hours. With a heavy westerly wind blowing, at the same temperature, the loss would be as much as ⅓ of an inch, and we have recorded ⅖ of an inch loss in the twenty-four hours.

*Protection against wind* is therefore important as lessening the loss. Shallow banks should be avoided, as they allow ready access of wind. A high close fence, erected close to the water, would be distinctly beneficial in this direction. The necessary accommodation for watering stock could easily be arranged for.

Lessening the surface exposed and increasing the depth is of importance as helping to preserve the supply. Moreover, reservoirs of small surface extent can be partially or altogether covered.

Access of sun heat will always tend to heat the water, but the effect is not so great in case of deep water as shallow, as all bathers know.

Referring now to the use of water plants for preventing evaporation from water surfaces, it is of interest to note that the late Dr. Fox. Bancroft, of Brisbane, communicated to the Linnean Society of Sydney* a note on the subject, detailing the result of some experiments made under various circumstances to test the use of water-plants as to their checking evaporation. The results showed that "evaporation was neither retarded nor hastened."

The experiments were not, however, of any magnitude—possibly not quite conclusive—and seeing that the subject has been reopened, it may be noted that should any person desire to make observations on the point, application to the Principal of this College will secure a supply of the *Azolla* mentioned. The plant will not foul the water, is readily transmitted by post or rail, and can be supplied in moderate quantity. Years ago the College sent supplies for this purpose to the western district, but with negative results. The subject is of more than passing interest, as it deals with a matter affecting an important industry. It is to be hoped, therefore, that a revival of interest in the subject will lead to something definite. We might find out positively whether evaporation can be checked or otherwise by the use of plant coverings.

## AN EXPERIMENT FOR FARMERS.

GEO. L. SUTTON,
Experimentalist.

IN this State the use of commercial fertilisers is gradually increasing. That the use of them on all soils is profitable is not an undisputed point amongst farmers. There are many who use commercial fertilisers, and find it profitable to do so, securing by their aid an increased yield. There are others who maintain that the use of artificial manures is unprofitable, and who consider the money spent on them as so many shillings per acre buried. This difference of opinion cannot be decided by argument. There are so many changes and conditions which occur during a season or series of seasons, and which cannot be taken into consideration, that the solution of this disputed point must be found by actual experiment, and the experiment must be conducted upon the farm itself.

It may be urged that a chemical analysis will show what the soil lacks, and from this it can be determined what ought to be added to the soil to produce a certain crop. Such, however, is not the case, for, whilst a chemical analysis will determine exactly what elements of plant food are contained in the soil, it does not determine what elements are in such a form as to be fully available for the plants' use. Experiments have demonstrated that soils of practically the same chemical composition vary greatly in their physical condition—a condition which has quite as much effect upon the plants' growth as the chemical composition of the soil.

---

* Proc. Linn. Soc., N.S.W., 1894.

It may be thought that the investigation of these matters should be left to the Experimental Farms distributed throughout this State, but soils vary so much in their chemical and physical properties, even in the same district, that the farmer must to a great extent determine for himself what element or elements of plant food his soil lacks. After determining the needs of his soil, the results of the experiments conducted at the different Experimental Farms will be of considerable value to him, and will enable him to purchase and utilise that form of fertiliser which has been found most suitable and economical for his particular climate and crop.

To conduct such an experiment on a farm may appear to be a source of considerable trouble, but, if thoughtfully planned and properly conducted, the trouble can be reduced to a minimum, and the experiment will entail but little extra labour; whilst the value of the information gained will far outweigh the slight extra cost of the additional work. For the information to be of any value the work done must be thorough; the experiment must be conducted with care and accuracy from start to finish. The plots for the experiment must be accurately measured, the fertilisers carefully weighed and mixed, and then evenly spread over the plots. The resulting crop must be carefully and accurately weighed, and *not estimated*. Estimation cannot be relied upon, for often appearances are deceptive.

An experiment conducted upon the lines of the one outlined by Prof. Voorhees in his work on "Fertilisers" will be found admirably suited for this purpose. A piece of ground, fairly representative of the land under consideration, should be selected. Mark off accurately a series of plots, ten in number, and each $\frac{1}{20}$ of an acre. If desired, the series can be extended, so as to include any area, but it is desirable that the plots should not be less than $\frac{1}{20}$ acre each. For $\frac{1}{20}$ acre plots, a convenient size is 198 feet (3 chains) long by 11 feet ($\frac{1}{6}$ chain) wide, though it is not essential that plots be of the dimensions stated, but may be altered to suit local circumstances. Yet it is advisable that the plots be long and narrow, so as to include as many inequalities of the soil as possible. Place firm, stout pegs at the corners of the plots, and number them from 1 to 10. Plough and otherwise prepare the whole of the plots as the remainder of the paddock is prepared. The plots are then to be treated as follows:—

Size of plots, $\frac{1}{20}$ acre.

Plot No.
1. Check plot. No fertiliser applied.
2. Apply nitrate of soda, 8 lb., at rate of 160 lb. per acre.
3. Apply superphosphate, 16 lb., at rate of 320 lb. per acre.
4. Apply sulphate of potash, 8 lb., at rate of 160 lb. per acre.
5. Check plot. No fertiliser applied.
6. Apply nitrate of soda, 8 lb.; superphosphate, 16 lb.
7. Apply nitrate of soda, 8 lb.; sulphate of potash, 8 lb.
8. Apply superphosphate, 16 lb.; sulphate of potash, 8 lb.
9. Apply nitrate of soda, 8 lb.; superphosphate, 16 lb.; sulphate of potash, 8 lb.
10. Check plot. No fertiliser applied.

If the soil be very uneven in character, I would recommend that the number of check or unfertilised plots be increased, so that every third one is a check plot. If this be done, it will require twelve plots instead of ten for the experiment.

The fertiliser should be evenly distributed over the whole of the plot intended for it, care being taken that none is applied to the adjacent plot.

To assist in the even distribution of the fertiliser, I find it a good plan to increase the bulk of the fertiliser by the addition of a considerable quantity of raw sand, or of dry soil from the plot, at the same time making all the mixtures up to the same bulk. I use for this purpose a kerosene tin, a vessel which, I think, is to be found on every farm. The fertiliser intended for the plot is placed in the kerosene tin, the tin is then filled up with sand or soil, well shaken, and then levelled off by drawing a piece of board across the top of the tin. This method gives very approximately the same bulk to each mixture. The contents of the tin are then poured through a sieve, with ¼-inch mesh, on to a piece of canvas or coarse sacking—a maize sack cut open answers admirably for the purpose. By alternately raising and lowering opposite corners of the sheet, the whole is rapidly and readily mixed.

It will be noticed that the amounts of fertiliser given are apparently excessive, and greater than the quantities generally used in actual practice. For accurate results it is necessary that the amounts of fertilisers be large, so that there may not be a deficiency of any particular element of plant-food. The amounts, if necessary, may be increased.

In using such large quantities of fertiliser, it is advisable that they be well mixed with the soil so as not to come into direct contact with the seed, for, the chemical action of some of the fertilisers is likely to have a detrimental effect upon the germination of it, and consequently spoil the accuracy of the experiment.

The cost of ingredients given is about 12s. 6d., when bought singly and at wholesale rates. I feel sure that for a slight additional charge the fertiliser merchants would supply the series of fertilisers accurately mixed, weighed, and labelled.

The after cultivation of the crop, if any, should be identical with that of the other portion of the paddock.

When harvesting more accurate results will be obtained if a small strip, say ½ yard in width, be first cut round each plot and removed. The portion remaining, which is not likely to have been affected by influences outside the plot, should then be carefully harvested and weighed.

As nitrate of soda supplies nitrogen; superphosphate, phosphoric acid; and sulphate of potash, potash, it will be seen that all the elements of plant-food, found necessary to add to soils to maintain their fertility, have been added, either singly or in combination with each other, to one or other of the plots in the experiment. By comparing the results of the various fertilised plots with those of the check or unfertilised ones, it will be seen whether it is profitable to apply one, two, or all the elements of plant-food found in fertilisers.

But definite information cannot be gained in one season, for seasons vary, and so it will require a series of seasons to give reliable and accurate results. As the experiment progresses, one's practice can be modified so as to take advantage of the information gained year by year.

It is likely that there are farms in this State on which it is not necessary to supply all the elements of plant-food found in fertilisers. One or perhaps two may be abundance. It is waste and unprofitable to supply these, which however may be quite necessary and consequently profitable in a neighbouring district.

This point can only be determined by similar experiments to the one outlined, and unless determined it becomes necessary as a purely business matter to suppose that all the elements of plant-food are lacking and consequently to supply them in some form or other.

Another feature of value which the carrying out of an experiment of this character will have will be to make oneself familiar with the different classes of simple fertilisers on the market and to awaken an interest in the composition and value of the different brands and mixtures offered for sale.

### *Result of an experiment to determine the needs of the soil, conducted on the farm of Mr. W. Percival, Clarendon, Richmond.*

The experiment was conducted amongst and comprised part of a field crop of maize of 8 acres which was being grown for ensilage. The soil was a light grey loam, locally known as upland.

The variety of maize grown was Early Red Hogan, obtained from Messrs. Yates & Co., Sydney. It was planted in drills 3 feet apart, the seed being planted at the bottom of a furrow 4 inches deep by means of a Farmer's Friend maize dropper. Single grains were dropped 12 inches apart.

The ground was in splendid tilth. The previous crop sown was Emerald Rye which, owing to the drought, was a partial failure; this was fed off and the ground ploughed. Previous to the rye being sown the ground had been prepared for sorghum which, however, was an entire failure. The ground had practically been bare fallowed for twelve months during which time it had received two ploughings. As far as we could judge the plant-food in the soil was in a very available condition, so that the crop could make use of it to the fullest extent.

Each plot was 80⅔ yards long and 3 yards wide, and thus contained 3 drills of maize and was $\frac{1}{20}$ acre in area. The fertiliser was sown and mixed with the soil at the bottom of the drill before the seed was planted. The maize was planted October 4, 1902, and germinated well in about seven days. During its growth it received the same cultivation and at the same time as the other portion of the crop. When about 2 feet high the whole crop was slightly hilled. The crop was harvested January 13, 1903. Just prior to harvesting part of each plot—½ chain of each drill at each end—was cut and discarded.

The remainders of the plots were then cut and weighed with the following results :—

| No. of Plot. | Fertiliser used. | Rate per acre. | Yield—Rate per acre. | | | | Increase per acre over unmanured plots. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | lb. | tons. | cwt. | qrs. | lb. | tons. | cwt. | qrs. | lb. |
| 1<br>5<br>10 | No fertiliser ... ... ... | ...... | 9 | 9 | 1 | 12 | | | | |
| 2 | Nitrate of Soda ... ... ... | 160 | 10 | 5 | 0 | 8 | 0 | 15 | 2 | 24 |
| 3 | Superphosphate ... ... ... | 320 | 10 | 6 | 2 | 16 | 0 | 17 | 1 | 4 |
| 4 | Sulphate of Potash ... ... | 160 | 10 | 6 | 2 | 16 | 0 | 17 | 1 | 4 |
| 6 | Nitrate of Soda ... ... ...<br>Superphosphate ... ... ... | 160<br>320 | 10 | 6 | 2 | 16 | 0 | 17 | 1 | 4 |
| 7 | Nitrate of Soda ... ... ...<br>Sulphate of Potash .. ... | 160<br>160 | 9 | 12 | 2 | 24 | 0 | 3 | 1 | 12 |
| 8 | Superphosphate ... ... ..<br>Sulphate of Potash ... ... | 320<br>160 | 10 | 9 | 0 | 0 | 0 | 19 | 2 | 16 |
| 9 | Nitrate of Soda ... ... ...<br>Superphosphate ... .. ..<br>Sulphate of Potash ... ... | 160<br>320<br>160 | 10 | 16 | 3 | 12 | 1 | 7 | 2 | 0 |

It is interesting to note that plot 7 fertilised with a combination of Nitrate of Soda and Sulphate of Potash produced a smaller yield than either plot 2 or plot 4, which were fertilised with the single ingredients, and in the same quantity. It will be noticed that each of the fertilised plots produced a slight increase over the unfertilised ones, and that the one having the complete fertiliser gave the largest though not a marked increase. From the fact that there is an increase even on such well prepared soil I think we may reasonably assume that this soil is not too abundantly supplied with any of the elements of plant food, and that to support continuous cropping it will require to be aided by the addition of all the necessary elements of plant food, either by mineral fertilisers or the aid of legumes or by stable manure.

## SEED OF PASPALUM DILATATUM.

By C. T. MUSSON.

Now that *Paspalum dilatatum* is so much grown everywhere, it would be well for buyers of seed to note that this grass (with others of the genus) is a very shy seed bearer. Its reputation is: hard to germinate; therefore, before purchasing, it would be well to have it tested, for much of the seed saved is not fertile, and consequently of no use.

### Tests.

A number of tests for vitality has been made at the Hawkesbury Agricultural College from seed grown here. In all cases, the percentage of fertile seed proved very low—only ½ to 2 per cent. Seed of this description, it need hardly be remarked, is of little use in the field.

Tests were continued, a variety of methods being adopted, in the laboratory, under conditions both artificial and as nearly natural as possible (in soil), with similar results. Some hundreds of flowers and so-called "seeds" from five species of *Paspalum* have been examined, with the result that only three fertile seeds were found in the lot.

Examination of the so-called "seed" gave the reason for such poor results clearly enough: *true seed had not been formed.*

### Why the Paspalum "Seeds" deceive.

Unless the *Paspalum* seed is carefully examined, or the examiner is aware of its peculiarities, it will readily deceive even the practised eye. One may have what looks like a splendid sample of seed, whilst really what appears to be seed is only the hardened protective case within which should be the seed proper.

### The Paspalum Flower.

The flower of *Paspalum* has two outer protective envelopes (called glumes), equivalent to the chaff in wheat. It should be noted that seed as marketed retains these protective parts. These turn brownish at ripening time. Within them is a seed-like body—hard, shining, brown,—which is often mistaken for the seed. It is not, however, a seed, but consists of two more protective glumes, one enveloping the other, and the two enclosing the true seed when there is one formed. The seed is quite distinct, and in no way attached to the covering parts mentioned except at its base.

The flower can easily be dissected with a needle or pin and a penknife, in a good light, by means of the naked eye—better, of course, with the help of a pocket magnifying glass,—when the presence or absence of a true "seed" is easily established.

It would be well for anyone intending to sow this seed to examine it before doing so, and thus possibly prevent much disappointment and loss of valuable time.

### How to Test it.

An easy way to test seed is to put a few (100 if possible, as the percentage of fertility is more easily calculated) between blotting-paper, kept moist and placed between two plates, the top one turned upside down. The test should be kept in a warm place—anything between 70 to 90 degrees will give best results. The seed should be examined at intervals, and the test should not be kept up longer than seven to ten days. This will show results one way or the other. The percentage to be expected will vary according to the class of plant. Grasses, for instance, might be taken at 50, cereals at 95, clover at 95. Anything below the standard is a poor sample.

### Why Paspalums do not Seed well.

As to why the *Paspalums* do not seed well here, we are not in a position to say. The seed varies very much, and such factors as unfavourable weather at seed setting or ripening time, variable climatic conditions, age of stand, kind growing, collection of seed before it is ripe, will all affect results. These and other matters in this connection are under experimental review, and will be dealt with in detail at no distant date. Meantime, it may be noted that one stand of this grass—three years old—seeded naturally very well, though in that case plants apparently only gave a few fertile seeds each, for the resulting seedlings were not particularly abundant. Perhaps it is a case like that of the Kangaroo grass—few seeds are produced, and of these only a small percentage fertile. Without doubt, division of the roots remains the best method of propagation for *P. dilatatum*. We are, however, on the lookout for a sound seeding *Paspalum*.

### Seed can be Tested at the College.

Any *Paspalum* or other seeds can be sent to the College for testing, and will be duly reported on. At least 200 examples should be sent of small seeds. Twenty-five or fifty would be sufficient in case of large seed, such as beans and peas. Samples should be representative of the bulk and not selected.

## HAWKESBURY DISTRICT FARM NOTES.

H. W. POTTS.

*Lucerne.*—The past two seasons of drought have brought into prominence the immense value of lucerne as green and dry fodder. The crop is essentially one for dry soils and climates. Those who have been fortunate enough, and sufficiently far-seeing, to follow up the growth of this splendid fodder, have certainly had good reason to be satisfied with the substantial returns of their enterprise. Increased attention deservedly is now being devoted to lucerne cultivation. The plant thrives best in a rich calcareous soil. It is practically immaterial whether the lime be found in the soil or sub-soil. Lucerne seems to do well in any soil with a porous sub-soil, which is open and so located as not to permit of water lodging either on top or in the sub-soil. Many farmers have been persuaded that their soil is not rich enough for lucerne, and sufficient experiment has not been made. It is surprising how lucerne will thrive, even on poor soils, so long as the drainage is adequate and the soil of sufficient depth. The striking feature of its growth is the power of the plant to be independent of rain, owing to the extraordinary facility it possesses of penetrating many feet to secure moisture. Towards the end of this month sowing operations may safely be taken in hand. The main precaution to adopt in the development of a sturdy growth is to have a clean, well-cultivated seed bed. In our warm climate, weeds readily spring up, foul the land, and choke a healthy growth of lucerne. Land that is heavily manured, well drained, with good depth of soil, preferably after a fallow crop, and in clean condition, should be selected. Potatoes are a good crop to follow. Farmyard manure is liable to introduce weeds. A good substitute is 3 or 4 cwt. of superphosphate with 1 cwt. of sulphate of potash. In the selection of good seed, free from dodder, a question of vital importance is again encountered. It should only be bought from reputable sources, with a guarantee of its purity as a result of analytical test. This will be conducted at this College free for any farmer who is in doubt as to the purity of seed he has obtained for sowing, and who will forward a small quantity—say a tablespoonful—taken from the bulk. Of late years little or no complaint has been made; but in view of the annoyance and loss entailed in the selection of infected seed it is best to be assured of its purity. Twenty pounds to the acre is considered an average amount to sow broadcast, and care must be taken that it is spread evenly.

*Cow-peas.*—Again the cow-peas have proved admirable drought-resistant forage plants, giving good yields of green succulent food at a period when the choice is extremely limited for stock. Cows at first do not take kindly to this class of green fodder from a grazing standpoint. It is quite apparent that the cow taste for cow-peas is acquired. They have to be coaxed, and, in fact, rendered hungry, before they will tackle this new fodder seriously. With pigs the case is entirely reversed. A visit to the paddock of cow-peas to which pigs have access in the early morning promptly dispels any ideas of this crop being unsuitable for swine. Young and old revel in it. They rapidly mature, and soon prove that it is an ideal fodder for pigs. It will take a few years to bring the usefulness of this fodder in a convincing way before farmers. A visit to the College at this juncture would give an insight to its food value. This is entirely apart from the manurial gain and its importance in a rotation. For green feed, for its matured beans, for hay, for ensilage, for green manuring, cow-peas have a splendid future in our arid areas throughout Australia. We have yet to test and realise its unlimited possibilities as a stock food.

*Rape.*—For sheep, pigs, and poultry, this is a crop which will give several successive cuttings, and ought to be largely cultivated this month. As a forage plant its full value—particularly for sheep—has not yet been fully recognised. When once the growth is started it has a sound reputation for resisting the extremes of heat and cold. It further possesses special qualifications for clearing land. It can be grown as a catch crop, to provide green manure or forage for almost any kind of stock kept on a farm. Compared with clover, it has twice the food value, and will provide a crop twice the weight per acre. The Dwarf Essex is the best variety, and may be sown at the rate of 3 lb. seed per acre drilled, and from 5 to 7 lb. broadcast. This crop will be found to thrive best on land recently cropped with maize. The most effective fertiliser to use for this crop is farmyard manure; in the absence of this, artificial manures rich in phosphates may be applied. A good growth is generally ready in from eight to twelve weeks. It has often been noticed that farm animals do not readily eat rape, and will reject it at first. It is an acquired taste, and it is frequently necessary to confine them until they take to it. Once they do, it is eaten ravenously. Fifteen sheep have been fed to the acre, and made fit for the market in sixty days.

*Swedes.*—This crop is generally raised in this district for market purposes, and for that purpose the best variety to sow this month is Purple Top—3 to 4 lb. of seed per acre, in drills 2 feet 6 inches to 3 feet apart. Very heavy land ought to be ridged with the plough. For stock feed, the Monarch or Tankard varieties are heavy yielders.

*Sorghums.*—The claim put forward for this crop in summer that, when once established, during a drought it will flourish after maize has come to a standstill, has been fully justified this season. Again, we know how it will thrive under such widely different conditions of soil and climate, especially where the variety selected for the crop is of rapid growth, hardy, quickly maturing, and of good forage quality. The earlier sorts of amber cane have once more demonstrated their value to the farmer this season, despite all the drawbacks of a hot, dry summer. The crops sown in December and January have responded well to cultivation. The early-sown crops are now in full flower, and may be cut green and fed to dairy cattle and pigs with lucerne. For an early autumn green crop it may be regarded as essentially a milk-food, and one of the best to stimulate the flow. As dry forage, cut fine, and balanced in a ration with bran or grain, it is a serviceable winter fodder for horses and stock. When properly cured it will last the winter through. In its green stage it may be properly conserved as ensilage, either alone or mixed with equal parts of maize. As a cattle food it will be advantageous to cut in with it moderate quantities of lucerne, cow-pea, or other suitable leguminous crops.

*Maize.*—The dry, parching weather, with its accompanying hot winds, effected incalculable damage towards the end of January throughout the maize-growing districts. This was more keenly felt on the northern rivers. Whilst many acres of the damaged maize has been wisely converted into ensilage in the stack as forage, that which is allowed to stand to ripen as corn is passing through a precarious and uncertain stage. The earlier varieties, such as King of the Earlies, Iowa Silvermine, Early Mastodon, Clarke's Mastodon, Pride of the North, Riley's Favourite, and Abercrombie, are now fit to harvest. Amongst these are several new sorts, and it will be wise for farmers to obtain samples of these to test, especially Riley's Favourite and Clarke's Mastodon. All the early planted corn, especially that planted in September, will be ready to pull this month; in fact, all along the river we find the usual operations in full swing of pulling, drying, husking, shelling, and finally bagging for market. Notwithstanding the importations of maize from the Argentine, it promises to maintain a high price this winter. The husker and shredder now in general use is proving an excellent labour-saving farm machine. Furthermore, it is bringing within our reach as a serviceable fodder, shredded stover. Stover has of late years found a place as a winter fodder. It has a higher food value than has generally been accredited to it. In the United States it is claimed to have proved useful as a food for idle horses and colts in winter, and this was definitely proved correct by practical test at the College last winter, when a large stack of stover was fed to the horses and colts, and the results quoted in America fully confirmed. This ought to be noted for the coming winter. Both dairy cattle and other stock have been fed on it.

*Cereals.*—The whole strength of the farm should be largely utilised this month getting the ground in order for sowing cereals.

*Wheat.*—The Macaroni wheats, if sown early, will provide a crop of green feed for mid-winter, and with normal season a further crop in November. Blount's Lambrigg has an excellent reputation for green fodder.

*Barley.*—Along the coastal areas, crops of barley may be sown this month, where the advantage of occasional showers may be gained. This crop does best on a well-drained, light, warm soil. The skinless variety is the earliest for green forage, and gives a good yield. A cut may be taken in June with a second later on. Cape barley may be sown alone or with an equal quantity of peas for green food.

*Paspalum dilatatum* grass at Hawkesbury Agricultural College, planted 6th August, 1902.

*Oats.*—Algerian oats may be sown this month, even if the ground be parched. The seed is best in the soil and ready for the rainfall. For hay, this variety always gives the most satisfactory returns. The White Tartarian will yield the greatest weight of green fodder. Where the soil is suitable a crop of oats, with peas, will give excellent results as fodder for dairy cattle in promoting and maintaining milk flow. Sow early 1¼ bushel of each per acre.

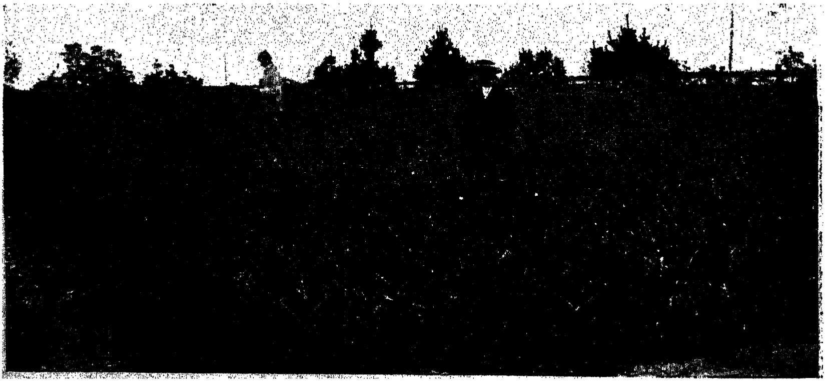
*Rye.*—This is one of the hardiest crops to grow for winter feed. It thrives on poor soil and withstands drought. It can be grazed all the winter, and ends its useful career by producing a crop of hay in the spring.

*Brown Millet.*—Where these millets had the advantage of good soil, with the early summer rains, this growth has been characterised by a sturdiness which must result in a good return from the heads; and in this regard care should be exercised to obtain the maximum returns by harvesting before the seed reaches its final stage of ripeness.

View of the same plot in December, 1902.

*Paspalum dilatatum.*—The roots of this grass may be subdivided this month and planted 4 feet apart in the paddocks, or, where the ground is cultivated and rapid growth encouraged, the distance may be reduced to 18 inches or 2 feet.

*Horse beans, black vetches or tares, peas, and crimson clover* may be sown this month.



The same plot (from another position) in January, 1903.

# Farm Notes.

## BATHURST DISTRICT.—March.

R. W. PEACOCK.

Owing to the protracted dry weather, ploughing can only be carried on with difficulty, and many farmers are waiting until rain falls. Although the land may be hard, it is not wise to wait too long, as one of the main factors which militate against success is sowing late. The ploughs should be kept busy during the month to prepare the land for early sowings of cereals. One of the best investments of the farmer is in ploughshares to plough the land during dry weather, for when so treated the land is more retentive of the showers which fall, and is aerated, sweetened, and liberates plant food, which is available for the ensuing crops. It also possesses better texture and mechanical condition than land which is ploughed whilst wet, and possesses the advantage of being ready for the reception of the seed when the earliest opportunity offers.

The drought so far has prevented much provision being made for green winter fodder, and extra efforts should be made during the month to meet the deficiency.

*Wheat.*—Sowings should be made of some early-maturing variety for green winter fodder early in the month. Towards the end of the month many of the long-season wheats, such as the Lammas, Tuscans, &c., may be sown, and if the season should be favourable these would produce a large quantity of green food during the winter to be grazed off rationally by stock. Many good yields of grain have been obtained from wheats so treated. The early-maturing wheats should not be sown until April, for if sown earlier there is a probability of their becoming frosted during the spring.

*Oats.*—A sowing of Algerian or other quickly-maturing variety should produce good green winter fodder, and should be sown early in the month.

*Barleys.*—These should be sown largely early in the month for green fodder. The Skinless and Cape varieties are the best for this purpose. They require a soil in good heart and with a fair quantity of available plant food near the surface.

*Ryes.*—Emerald and "Black Winter" are suitable varieties, and should be sown early in the month for green fodder. They possess the advantages of producing fair yields from poorer soils than the other cereals, and withstanding greater degrees of cold. They are valuable in these respects for such lands. They also yield heavily upon good soils.

*Tares and Field Peas.*—These can be sown for fodder or green manuring during the month. When sown in conjunction with the foregoing cereals they add materially to the quality of the fodder. The Black Tare and the Grey Field Pea are two of the best for these purposes.

*Rape.*—Should be sown largely during the month. It requires well-prepared land, is a rapid grower, of excellent fodder value, especially for ewes and lambs. It is a moderately deep rooter, and withstands a fair amount of dry weather, and is valuable in a rotation. The Dwarf Essex variety is the best.

*Root Crops.*—Turnips, swedes, carrots, and parsnips should be sown. They require deep and thorough cultivation, and produce excellent food for all classes of stock, possessing the advantage of being easily stored for the late winter months.

*Lucerne.*—This plant has been rightly termed the "King of Fodders," it being one of the most nutritious and prolific of all crops. It should be sown towards the end of the month, if the weather is favourable, upon deeply-worked well-prepared soil. As it occupies the land for many years, good thorough cultivation is well repaid by the better stand and more substantial yields than are obtained by more slipshod methods. It is not wise to sow it with a shelter crop, it doing much better alone, and should be sown early in order to establish itself before the dry weather of the ensuing summer. It thrives best upon rich alluvial soils unbroken by any stratum of coarse sand or gravel. Upon the lighter soils it produces a fair amount of fodder, and will last for several years, and is valuable in a rotation.

*Grasses and Clovers.*—Many perennial grasses and clovers should be sown about the end of the month upon well-prepared land. When sown during the autumn they establish themselves, and can better withstand the dry summers, which are the rule in this district.

The growing crops will require cultivating and keeping free from weeds. Some of the early maize will be ripe enough to harvest this month, and the stalks should be cut and stood on either side of a fence or rails arranged for the purpose. They retain their fodder value longer if so treated, and if shredded before being fed form an acceptable bulky fodder for the dry stock during winter.

## RIVERINA DISTRICT.—MARCH.

G. M. McKEOWN.

*Wheat.*—As May is the best month for sowing for grain production, the work of preparing land should be pushed forward as rapidly as possible. Owing to the long continued dry weather, ploughing with mouldboards in stiff soils is difficult, and the use of the rotary disc plough is recommended, as its most valuable work is done in dry soils in which mouldboard work is unsatisfactory and more expensive. Land which has been fallowed should be worked with scarifier, harrow, or spading harrow to assist in retaining such moisture as may be available. The best varieties for hot dry districts are Hudson's Early Purple Straw, Farmer's Friend, Steinwedel, and Australian Talavera. Wheat for hay should be sown in March or early in April. The best varieties are Berthoud or Zealand, and Australian Talavera. Seed should be sown at the rate of 45 lb. per acre, and with it should be drilled in about 60 lb. No. 2 superphosphate. Seed should be graded, and only the plumpest used for sowing, as numerous trials prove that the best results are obtainable from seed of the best quality. For grain production, I use about 60 lb. B manure, or a similar quantity of No. 1 superphosphate, which is drilled in with the seed. Even as small a quantity as 25 lb. per acre of either of these manures will give highly profitable results, and the cost, viz., 1s. to 1s. 2d. per acre, should be within the reach of any wheat-grower. For smut or bunt a 2 per cent. solution of bluestone is used, the seed being immersed from five to ten minutes, the latter being allowed for plump seed. An excellent stimulant for a crop will be provided by mixing from 8 lb. to 14 lb. of superphosphate with 4 bushels of grain while it is damp after removal from the dip. In all cases, seed should be sown with the drill, as far less seed and manure are required, and better crops are obtained, than from broadcast seed.

*Rape.*—Should be sown during this month in finely-prepared land. Sow 2 lb. to 3 lb. of Dwarf Essex if broadcast, but much less will be required if sown with a drill.

*Oats.*—Should be sown in March, as advised in last issue. The best variety is the Algerian. Seed should be sown at the rate of a bushel per acre for hay, half the quantity of selected seed being sufficient for seed production. Manure with about 60 lb. No. 2 superphosphate per acre.

*Barley.*—Land should be got ready to admit of sowing seed during April or early in May. The soil, which should be of as good a quality as possible, should be ploughed to a depth of 6 inches, and brought into fine tilth by harrowing and rolling if necessary. Sow Chevalier for malting, and for green fodder use the "skinless." The skinless variety is the best for fodder, as it thrives in dry weather, and being free from awns or beards, it may be used till it is more advanced than than the bearded kinds. In the higher portions of Riverina, which possess a better soil and a larger rainfall than the lower lands, malting barley may be grown with a better chance of success than in the lower portions of the district, where it is rather a risky crop.

## Kitchen Garden.

Tomatoes should be trained on stakes and kept well tied up. All superfluous growth being checked. The vines should be watered if possible, and well mulched. For Rutherglen bugs, or other insect pests, dust slightly with unslacked lime. A pair of vine bellows will be found the best medium for distribution.

*Pumpkins, Squashes, and Melons.*—Mulch, and, if possible, water, the vines. Keep the surface soil stirred between the rows, and round the plants. Stop all superfluous growth. For insect pests, use lime as advised for tomatoes.

*Cabbage and Cauliflower.*—Sow seed in shaded sheds for succession. The best varieties are St. John's Day, Early Drumhead, Succession, Early Spring, and Early Summer; while of cauliflowers, Algiers, Early London, and Burpees "Dry Weather" will give good results.

*Turnips.*—Sow in drills, Orange Jelly, Model, Jersey Lily, and White Nepaul.

*Peas.*—Sow a few Yorkshire Hero, Daisy, or Stanley.

Sow also carrots, parsnips, and beet.

## LEMON-TREES LOSING THEIR LEAVES.

A CORRESPONDENT asks for information as to the cause of a lemon-tree losing its leaves. "The leaves have been falling off since last summer till it is now nearly bare, though the flower-buds have come in great numbers. The tree has been manured with well-rotted stable manure this winter, though manure had not been applied during the two preceding winters. The manure was lightly forked in, so that the roots have not been disturbed. The tree is growing in sandy soil, on a slope, and has been in full-bearing for some years. Would too much water last summer cause the leaves to fall? This tree was watered for about an hour once a week throughout the summer.

"Would you also tell me if there is any remedy for collar rot in a lemon-tree when it is beginning?"

Mr. J. Alford, Orchardist at the Hawkesbury Agricultural College, reports that lemon-trees will be affected in the way described when the drainage is imperfect. Deep planting is another cause. Citrus-trees should always be set out in such a way as to keep the worked part (*i.e.*, the union of the bud or scion with the stock) above ground. With the tree in question, if it is found that the union is below the surface of the soil, and this may easily have been brought about by lavish applications of stable manure, the soil should be removed until the worked part of the tree is well exposed to light and air.

Collar rot (*mal di goma*), or gumming, is a disease primarily due to defective drainage and smothering of the root-system with rich manures. The first symptoms are exudations of gum from the stem, then the foliage gradually becomes yellow; finally the leaves drop, and there is a profusion of bloom. In the first stages, the disease can be successfully treated by cutting away with a sharp knife all the diseased bark and sap wood. As a rule, this will be found to extend an inch or two below the surface of the soil. When there is nothing but sound bark and wood left, smear the surface with a mixture of Stockholm tar two parts and carbolic acid one part. If it happens that the disease is so far advanced that the stem is entirely girdled with decayed bark and sap wood, it is better to remove the tree, and carefully dress the ground with a heavy sprinkling of lime. By removing the earth from about the base of the tree, and applying 2 or 3 lb. of slaked lime, the disease can in some measure be arrested. The annual whitewashing of the trunks of lemon-trees is also a good check; but nothing can effectually prevent the disease if the drainage is bad, or the trees are overdosed with manures rich in organic matter.

In the case of quite young trees, it is not a bad plan to transplant and reset them almost on the surface.

# Orchard Notes.

W. J. ALLEN.

## MARCH.

THE latter part of this month will find the fruit-grower congratulating himself on the fact that the rush of his summer work is just about over, the stone fruits, with but few exceptions, having been marketed, and in many districts the apples and pears also. In the cooler districts there may be some growers who are holding such fruits, but, generally speaking, the grower of good fruits finds a ready sale for same as soon as they are in a marketable condition, and they are sent to market as soon as they are ready. Some of those who hold the fruit for a time simply pick it, put it in cases, and allow it to remain under the tree and in the shade; the boxes are then covered up and exposed to all kinds of weather, yet notwithstanding this apparently rough treatment I have seen apples kept in perfect condition for some months in this way.

There are many plans for building storerooms for apples; the following description, taken from Wickson, being that of a room built by Mr. Edward Berwick, of Monterig, one of the leading apple-growers of the coast region in Southern California:—"The apples are carefully hand-picked into baskets, and at once transferred to ordinary apple boxes—just put in loose, not packed tight as for shipping. These boxes are hauled to the fruit-house with as little jar as possible. This fruit-house is built of rough boards (fastened on a heavy frame), with inch-thick battens, thus leaving an inch air-space between the boards and the rustic. It is of two stories, the upper devoted to tools and stores, the lower used for fruit, and arranged with shelves accordingly. This lower story has only an earthen floor. One object of this is to give no lodgment for rats or mice—the other is to serve as a means of maintaining a cool, damp atmosphere. To this end it is kept well watered in apple-keeping season; and to avoid mildew or mould, it is also liberally sprinkled with ground sulphur. By day, doors and windows are mostly kept shut, by night open; this, of course, is to exclude the heat and allow free circulation of the cool night air."

Of course one does not expect to keep autumn apples for any great length of time, more particularly those grown in our warmer districts, but in the cool, mountainous country, even these may be kept back some little time, while the better varieties of winter apples may be kept for some months.

In visiting the different apple-growing centres, I find that the great majority of the growers are in favour of a Pests Bill, as it is claimed that without united action there is but little hope of their ever keeping in check the remorseless foe of the apple-grower—the codlin moth—because while many of the growers may be using every known means of keeping it down, there are always those who give their trees but little attention, but are most successful in breeding good crops of the moth, which in their turn relieve these indolent growers from the worry of marketing large crops, the fruit, such as it is, being naturally of a quality on a par with the quantity. It is such growers who help to keep the careful, industrious man back.

So far as the scale diseases are concerned, we know that by fumigating, or systematic spraying, these can be kept in check by individual growers, but the codlin moth can only be kept within reasonable bounds by united action on the part of all the growers of apples, pears and quinces. The question is, will they work together with the object of defeating the yearly ravages caused by this pest?

Wherever the citrus trees are found to be covered with red and other scales no time should be lost in fumigating them. If the grower has no tents, but on the other hand has a spray pump, he should spray at once with either the resin, soda and fish oil, or the blue oil emulsions, recipes for mixing which have been given in previous issues of the *Gazette*.

The French Prunes and Gordo Blanco or raisin grapes will be ripe enough to pick, and in the case of the latter where they are to be dipped, the same strength of lye may be used as for the prunes—that is, a pound of caustic soda to 8 or 10 gallons of water, just on the boil; the fruit should be allowed to remain in this for about two seconds, when, if the lye is sufficiently strong the skins will be found to be slightly cracked. If cracked too much the appearance of the fruit is spoilt. The fruit should never be permitted to become too dry before removing from the tray to the sweat-box. In the case of prunes they should be immersed in boiling-water, or steamed in a retort for at least five minutes before packing; this last dip is best done on a hot day.

There is one very important work which fruit-growers should not fail to do every year, and that is to take careful note of how the trees, fruits, and vines have succeeded under their system of cultivation and pruning. If too much wood has been left the chances are that the size and quality of the fruit has suffered in consequence. It may be that the fruit on trees or vines showed no signs or ill-effect from the over cropping until about a month or so before ripening, when instead of developing and maturing as it should, it stopped growing and gradually ripened without attaining a proper size.

This is a very important matter which growers should keep constantly in view, and at no time during the year can the results of different methods of pruning be seen so well as when the fruit is ripening, when each variety should be closely watched and such notes taken thereon as will serve as a guide for the following year's pruning. It is always well to bear in mind that trees or vines must not be overloaded if they are expected to produce regular crops of high standard fruits, which quality alone will always command the highest prices on the market, and repay the grower best while taking the least out of the trees or vines.

Those who are the most successful in fruit-growing have found that they have had to combine a thorough system of cultivation with proper pruning and judicious manuring to attain these results. There is a time when each of these several branches of the work should be done, and by neglecting to properly attend to any one of them certain loss to the grower will inevitably follow.

Codlin moth should still be watched most carefully, and all grubs killed which have found shelter in the bandages; also all fallen fruits should be picked up and destroyed.

Winter crops intended for green manuring the orchard should be put in this month, so that they will be well grown and ready to plough under in the early spring before the dry weather sets in.

Those who intend planting more fruit-trees this coming winter should not be late in preparing the soil and putting it into a fit condition to receive the young trees.

Budding young nursery stock may still be carried on during the early part of this month.

## A New Machine for Crushing Apples for Cider.

At the recent agricultural shows in France there has been exhibited an apple-crushing machine on the Débrosse system, made by Messrs. Mabille frères, the well-known engineers at Amboise (Indre-et-Loire). The principal part of the machine is a vertical circular disc, in place of the cylinders or cones seen in the ordinary crushers.

This disc is fixed with keys directly on the shaft which carries the driving pulleys and revolves against an inclined counter disc, the two forming a closed angle. The vertical disc carries a certain number of movable blades, which are perpendicular against its surface, and slide forward and backward during each revolution by means of an eccentric collar. The upper part of the counter-disc is fixed by a hinge, and the lower part rests on a spiral spring held by a set screw.

The apples thrown into the hopper fall between the two discs, and are drawn in by the blades towards the narrowest part, where they are elongated and flattened. These blades draw the apples without scraping them, because through the action of the eccentric collar they withdraw themselves progressively in following the movement of the disc. The apples are thus crushed between two level surfaces without being disintegrated.

Scrapers are placed under the disc which carry away portions which might adhere to it, and thus prevent the machine from choking.

The degree of fineness of the crushing can be regulated by the set-screw, which holds the inclined counter-disc. The machine has a large production, and requires relatively very little power to drive, and the work is very regular.

There are five different sizes, which according to their dimensions have more or less blades on the vertical disc; the smallest size has four blades, and the largest twelve.—L. de Sadriac, in *Journal de l'Agriculture.*

# Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

## DIRECTIONS FOR THE MONTH OF MARCH.

### Vegetables.

AFTER a very trying summer the advent of autumn will be looked forward to with much thankfulness, and in the hope of the rainfalls which are likely to occur during that season.

Throughout the coastal districts the weather has been satisfactory for vegetable cultivation, except in a few places; but inland the prevalence of considerable heat and drought has necessitated the giving up of vegetable culture except in the vicinity of some of the artesian bores, and near permanent water supplies.

At the artesian bores all kinds of vegetables can be produced in abundance, and particularly the cabbage and other members of the Brassica family.

The time is opportune for digging and manuring of ground for such permanent vegetables as asparagas and rhubarb. If the land be prepared during the present month it will then be in a satisfactory condition for early planting in the spring or, in places which are not too cold, in the winter. The Globe Artichoke is another permanent vegetable worth attention; and then a good collection of herbs is a necessity in all vegetable gardens and should be planted. Another good vegetable, but seldom grown here, is the sea-kale. To some extent, it might be termed a permanent one, and it certainly deserves to be grown.

When trenching the ground take steps to ensure good drainage, or heavy falls of rain may, in some soils, cause the trenched area to become a kind of swamp, to the injury, and perhaps loss, of the vegetables planted.

*Bean, French or Kidney.*—In the coldest parts of the State it is possible that frosts may occur at any time during the autumn, therefore it will be unwise to sow any of the beans classed as French, kidney, or haricot; but in the warm coastal districts seed may be sown to any extent required. Old plants, which have practically ceased to produce pods had better be pulled up to make way for something more productive; but it would not be advisable to grow more beans on the same ground at present. Cabbage, potatoes, cauliflower, celery, or some other vegetable of a different order to the bean had better be grown.

*Bean, Broad.*—This useful vegetable should be grown to some extent; but it is rather early to plant the seeds extensively during this month. A row or two, however, is worth trying. Rather heavy soil will be found to suit it better than soil of a light or sandy nature; but for all that, it will produce fairly good beans on the light soil.

*Beet, Red.*—Sow from time to time during the month a little seed at a time in order to keep up a succession of plants ready to pull. Try the Globe varieties, for they generally give the most satisfactory results.

*Beet, Silver.*—Sow a little seed occasionally. Manure the soil well for this vegetable.

*Borecole or Kale.*—Sow a little seed occasionally, and whenever plants are ready put some out in a well-manured bed. In cool districts this vegetable should be largely grown, for it may be expected to grow in great perfection.

*Cabbage, Broccoli, Brussels Sprouts, and Cauliflower.*—Sow seed occasionally, and when plants are suitable set them out in richly-manured ground, and keep them going without a check if possible.

*Celery.*—Sow a little seed, and plant out if any plants already raised are suitable for the purpose. Use abundance of manure and water to produce good and satisfactory plants.

*Cress and Mustard.*—Sow a little seed, and encourage the growth of the plants by occasional applications of liquid manure.

*Endive.*—Sow a little seed, and transplant to well-manured ground the young seedlings as soon as they are strong enough to move.

*Leek.*—Sow seed as extensively as may be required. Plant out the seedlings when about the size of a lead pencil, or larger, to heavily-manured shelter-trenches, and water well during their growth.

*Peas.*—Sow a few rows occasionally, and try two or three varieties—dwarf, medium, and tall.

*Radish.*—Sow a little seed of various kinds of radish from time to time. Use whilst small and tender.

*Sea-kale.*—Sow a little seed in a seed-bed, and next month full directions will be given as to the best way to treat the plants.

*Spinach.*—Sow seed in drills in rich ground. Thin out the seedlings when they are well above ground to about 18 inches apart.

*Shallots and Garlic.*—Plant out in rows about 1 foot apart.

## Flowers.

March is an important time for the gardener for there will be many matters to attend to, and work prepared now will have a great deal to do with the subsequent beauty of the garden.

First of all, there are the bulbs to plant, and the earlier this is done the better, and the greater chance they will have to make roots before the flowering season begins.

Now is the time to plant daffodils and narcissi of all kinds, crocuses, tulips, snowdrops, snowflakes, anemones, ranunculuses, ixias, babianas, sparaxis, the beautiful Watsonia O'Brieni and other kinds of Watsonia, as well as many other handsome and interesting bulbs. The general rule for depth of planting is to plant as deep as the diameter of the bulbs—that is, if a bulb measures an inch across, plant it an inch deep, and so on; but where the soil is of a dry or sandy nature the bulbs should be planted rather deeper.

If the soil is in a satisfactory condition and not dry plant out violets, primroses, cowslips, pansies, polyanthus, daisies, carnations, phlox Drummondii, and any other hardy plants that can be obtained. Get the best kinds of violets, and for warm places plant only the single flowering kinds, because, except under very favourable conditions, the double varieties are not likely to succeed.

Sow all sorts of hardy annuals, and also seeds of perennials; but the sowing had better take place after the middle of the month.

At the end of the month make ready for planting cuttings of roses and other plants, for during April cuttings are far more likely to strike roots than during the winter.

Prepare for the planting of evergreens.

AT ancient feastings eggs were consumed in considerable numbers, for it is recorded that at one in the time of Richard II no fewer than 11,000 were provided. In the reign of Edward I 450 eggs were sold for eighteen pence. In that of Edward II, A.D. 1314, eggs and other foods being dear, the price was settled by Parliament at twenty for a penny. In A.D. 1316 Parliament abrogated their decree, and then food was to be sold at reasonable rates. The prices allowed for the household of Henry VIII were "For eggs from Shrovetide till Michaelmas, the hundred, fourteen pence, Michaelmas to Shrovetide, the hundred twenty pence, which was evidence of their scarcity at the latter part of the year, and therefore of more value.

OVER five millions pounds worth of eggs are now annually imported into England, but not one half of these are used for culinary purposes. The calico print works use over 40,000,000 eggs a year, photographic establishments use millions of dozens, and wine clarifiers 10,000,000 dozens in the year; bookbinders, kid glove makers, and leather finishers use them in abundance, as well as other trades. The general public appear to have but little knowledge of the magnitude of the numbers wanted for practical commercial uses, apart from those of food, though in the latter respect not a few of the figures are absolutely startling; as an instance one of the London clubs alone contracts for more than 100,000 eggs a year.

# More about Eggs.—Original and Otherwise.

GEO. BRADSHAW.

THE first eggs of the brown egg layers are generally of a good colour, but as the hen increases her laying she decreases the amount of colour, owing to the gradual loss of the pigment which colours the eggs.

---

THERE are hens in every flock that do not lay enough eggs to pay for their board. There are individual hens in these same flocks that do the bulk of the laying. Economy comes in by breeding from the heavy layers, and getting rid of the inferior stock.

A CERTAIN amount of food is necessary to sustain life and produce an egg. If the hen does not get it, the egg-basket suffers. You cannot steal from nature without paying the penalty.

WE would rather have the story of the man who has succeeded with a dozen fowls than the story of the man who hopes to succeed with 10,000. What has been done can be done. What we hope to do is quite another thing.

MANY a time two dozen eggs have been sold for more than a bushel of corn, and a case of eggs for more than a load of potatoes. Even the most ardent "despiser of the hen" will be honest enough to admit that a case of eggs are produced cheaper and with far less manual labour than a load of potatoes.

REMEMBER that the hen that is laying needs about twice as much feed as she would need if not laying. Like any other machine, she must be furnished the material from which to manufacture her finished product.

WHERE market eggs are the object, it is better to have the birds of some purely distinct breed, that the eggs may be as uniform in colour and size as possible. Good taste naturally demands this; besides the hens of pure breeds lay better.

EGGS vary greatly in quality as well as in size. Some eggs are very poor in food value, others are very rich. Well-fed hens of good breeds will produce rich eggs of good size. Small, tough, bony, feathery hens, which spend all their energies scratching for a living, lay small and poor eggs. This is more important than has been thought; every poultry-keeper should give attention to producing a good quality of eggs.

KEEP the laying hens busy in scratching a good part of the day, and they will eat more and lay more. Feed them plenty of ground green bone, broken shells, grit, and vegetables. All of these, including scraps of meat, contain the elements needed by the laying hens.

THE civilised hen needs more lime than she is likely to get in her food. The hen that used to roam the wilds and lay eggs for a single brood of chicks per year needed little lime. But now we have put upon her the task of providing over one hundred eggs per year, and for the shells for that number of eggs a considerable quantity of lime is required.

FERTILE eggs with strong, vigorous germs can be obtained only from healthy stock well cared for. The fowls require plenty of exercise, sanitary quarters, and clean food, with pure water, some grit, vegetables, and green cut bone or meat meals.

DESPITE the various theories and methods suggested, no one has yet been able to know which egg will hatch and which will fail until after a certain period of incubation, and as to discerning the sex of the prospective chick within an egg, it is an impossibility.

THE scarcity of eggs, and the high prices that have ruled, should induce farmers to give hens their proper place on the farm. As a rule, all other live stock receive attention, being well fed and sheltered, but the fowls are supposed to be able to take care of themselves. The plan may result in the fowls being able to exist through the winter, but the hens do not lay.

T. F. SHUTT, of the Canadian Experimental Station at Ottawa, after testing a number of egg preservatives, concludes that the superiority of lime-water for this purpose is beyond question. In his experience no other fluid is its equal. The eggs kept in lime-water are much superior to those preserved by other methods.

A FRESH egg has a somewhat rough shell, while the shell of a stale egg is smooth. When cooked the contents of a fresh egg stick to the shell and must be removed with a spoon; but a stale egg, when boiled hard, can be peeled off like the skin of an orange.

HENS should be made to work for a good share of their food in winter. Some poultry-breeders keep their hens scratching all day with just enough grain scattered through the litter to encourage them to keep on scratching. Then a full feed is given at night, so that they go to roost with a full crop.

ONE great advantage in the poultry business is the quick returns on the investment. Eggs can be sold as soon as produced, and the chickens are ready for market in from three to six months.

ALBUMEN exists to a greater extent in fresh meat and ground green bone than anything else. Oyster-shell, grit, and ground dry bone are used to form the egg-shell. Of the grains, wheat, oats, barley, and maize come in the order named as regards material for egg-making. Of green foods, stewed clover comes first; cabbage, carrots, turnips, &c., follow as named. Turnips are over 90 per cent. water, and while they are better than nothing at all, they are a poor substitute for green feed.

---

EGGS kept at a temperature of between 40 and 65 degrees above zero may be retained much longer than when the temperature is higher, and they must also be turned, so as to change their positions, or the period of their profitable existence will be shortened. The longest period during which eggs have been kept and healthy chicks have been hatched is six weeks, they being stored in winter at about 50 degrees, turned three times a week, and placed in an incubator. After the sixth week, and up to the eighth, the eggs gradually failed.

---

SIX large eggs will weigh about a pound. As a flesh producer, one pound of eggs is equal to one pound of beef. About one-third of the weight of an egg is solid nutriment, which is more than can be said of meat. There are no bones and tough pieces that have to be laid aside. Practically an egg is animal food, and yet there is none of the disagreeable work of the butcher necessary to obtain it. Eggs, at average prices, are among the cheapest and most nutritious articles of diet. Like milk, an egg is complete food in itself, containing everything that is necessary for the development of a perfect animal. It is also easily digested, if not damaged in cooking.

---

BRAN is excellent for poultry, and one point in favour of bran is that it contains a much larger proportion of lime than any other cheap food derived from grain, and as the shells of eggs are composed of lime, it is essential that food rich in lime be provided. It may be urged that the use of oyster-shells will provide lime, but it will be found that it is the lime in the food that is most serviceable, because it is in a form that can be better digested and assimilated than carbonate of lime.

---

EGGS laid by an active, healthy hen supplied with good fresh food are much superior to those laid by hens that are the common scavengers of back yards and pig pens. The difference in colour, smell, and taste is very evident to one who has given the matter a little attention.

---

IT is a curious fact that while we had 200,000 head of poultry to spare for export during 1902, in the same period we imported several hundred thousand dozens of eggs from Melbourne, Adelaide, and China. The Chinese eggs are small and brown, but arrive perfectly fresh, and sell as readily as our own river eggs. It was thought the 6d. per dozen duty would effectually stop the Chinese article, but a miscalculation was made. The present price, it is said, pays the importers well.

EGG-PRODUCTION is one of the two very important purposes for which hens are kept. The pure-bred hen should be bred for egg-production rather than for showroom purposes if she is to perform her best function as a profitable farm fowl. The inquiry is beginning to be made for egg-laying strains, as it was a few years ago in cattle to inquire for milk strains. When this matter has been carefully managed for a few generations with pure-bred fowls, there will be no more inquiry for cross-breds to lay eggs. By careful feeding and selection, egg-laying strains can be improved.

---

REGARDING the keeping of eggs in cold storage, the temperature should be as low as possible without freezing the eggs, and maintained evenly. The proper temperature is from 30 to 33 degrees Fah. The air should be as dry as possible. When eggs are taken out of cold storage, they should not be taken out of the cases for forty-eight hours, otherwise the moisture in the air condenses on the shell, which becomes wet, and many wrongly think this a sweating or exudation from the eggs. If kept in the cases for two days, the eggs gradually become of the same temperature as the atmosphere, and all dampness is avoided.

---

DESPITE the instructions that only new-laid eggs should be placed in cold stores, many of those who utilise the Department's chambers ignore such. Northern river and other case eggs form a large portion of those deposited; these are delivered in the same state of freshness or staleness as received, but the limit of cold storage is as a preservative. Cold cannot regenerate, so that eggs stale when stored cannot be "new-laid" when delivered six months hence, but are in exactly the same stage, provided temperature and other conditions are right.

IT is not generally known to what extent the storage of eggs has grown since the Government a few years ago provided such facilities. At the present time Albury, Wagga, Junee, Cootamundra, Yass, Blayney, Orange, and a number of other southern and western towns are represented, the South Coast largely so, while nearly every township on the northern rivers has contributed a portion of the 120,000 dozens at present stored. Sussex-street egg merchants store largely for their country clients, so that distance from the city is no reason why all farmers should not participate in the advantages of a uniform market.

---

THE very high price of all sorts of poultry foods for the past six months has had the effect of reducing the quantities of eggs placed in cold storage. The actual depositors show an increase, but the quantities are reduced by the fact that the smaller breeders were obliged to sell their eggs to purchase poultry foods. Eggs for the past six months have been 20 per cent. higher than in the same period of the preceding year, but poultry foods have been 100 per cent. higher, hence the poultry keeper has been severely handicapped of late.

# General Notes.

## COFFEE-GROWING ON THE CLARENCE.

FROM accounts to hand, it would appear that coffee-growing on the Clarence River has passed the experimental stage, and that the industry is on a fair road to commercial success. Mr. John Bale some eight or ten years ago secured certain rights from the Government to found an experimental station at Wolbin Island. There he planted out several acres of young trees, which are now in full bearing. Already he has harvested 30,000 lb. of berries, and has still another 10,000 to gather. This means that each tree's yield is from 50 lb. to 60 lb., or fifteen 1 lb. tins of the prepared article. Retailed at 1s. per tin, the revenue represents a handsome income, as the trees are planted in rows about 20 feet apart. At this rate, and providing that a market can be secured for the product, the industry, on the same basis of success, ought to give returns much more handsome than any of the sub-tropical crops raised on the North Coast. The drawback to farmers used to returns ranging from monthly to yearly, is that there is no yield from the coffee trees till they are 4 years old, and then they are not in full bearing.

Mr. Bale has for many years devoted much of his time to crop experimenting. He has demonstrated that many crops, other than those now raised, can be profitably cultivated on the fertile Clarence as commercial ventures.

Besides raising the coffee in its raw state, he has also roasting appliances and modern grinding machinery, and turns out the coffee in labelled tins ready for the market.

In the latter end of 1896, Mr. Bale submitted samples of his locally-grown coffee to the Department of Agriculture. The samples were brought under the notice of Mr. C. Skelton, who had been engaged for seventeen years as a coffee-planter in Ceylon. He was greatly impressed with the quality of the berries, and some months afterwards, under arrangement, visited the Clarence and other Northern River districts, with the object of reporting on the suitability of the soil and conditions generally for extension of the industry which was proving so successful in the admirably-adapted site selected by Mr. Bale.

In the *Agricultural Gazette* for October, 1897, page 744, Mr. Skelton published his opinions concerning the capabilities of the districts mentioned. As many present readers of the *Agricultural Gazette* have, perhaps, not seen the report, some extracts from it are now reproduced:—

"In all three districts—Clarence, Richmond, and Tweed—I saw large tracts of land, cleared and uncleared, well suited for coffee-culture; soil and climate are all that could be wished for. I saw growing in the different districts, strong, healthy, well-grown trees, in many instances laden with fruit. With the wonderful fertility of the soil, and the general suitability of those parts of the Colony for the purpose, it is surprising that the industry has not progressed beyond the experimental stage.

"The conditions for planting here being somewhat different from India, and Ceylon, where cheap coolie labour is obtainable, I believe it would be an advantage to set the coffee trees about 7 feet apart, or even more, so as to permit of the employment of a light one-horse scarifier to keep down the weeds, and also to allow of the passage of some sort of vehicle between the trees in gathering the crop. With the exception of planting and pruning, which latter commences after the second crop has been gathered, nearly the whole of the work can be carried out by ordinary labour. The picking of the berries is essentially women's work. A good picking woman can gather twice as much as almost any man, her fingers being so much more nimble."

The chief risk to be avoided in coffee-growing is that of frosts, but Mr. Skelton observed very many sites on well-sheltered hillsides where there would be little risk of injury from such a cause.

## EXPERIMENTS IN THE DESTRUCTION OF GRASSHOPPERS.

IN the districts subject to visitations of grasshoppers or locusts, the question of some effective method of destroying the pest is a vital one. In 1901, arrangements were made to obtain from South Africa a fungus which has been used there more or less successfully for a considerable time in the destruction of locusts, which in that part of the world are even a greater scourge than they are here. The Entomologist distributed quantities of cultures of the fungus to pastoralists, who undertook to endeavour to inoculate the swarms. The first attempts were not very conclusive, on account of the extreme aridity of the season. Last spring weather conditions were more favourable for the development and spread of the disease which the fungus is supposed to set up in the insects which become inoculated, and, accordingly, Mr. Froggatt visited Condobolin and other centres to conduct experiments, while a number of pastoralists in various parts of the country that is periodically swept by the locust pests also made trials.

In reporting the results of the experiments on his estate at Condobolin, Mr. D. H. Tasker states:—"All I can say in the matter is that one week after your experiment at my place every grasshopper was dead, but whether it was from the effects of the fungus I cannot say."

At Narrandera, the grasshoppers disappeared before there was an opportunity to try the fungus. Mr. Geo. Gow, of Mumbledool, sent some of the fungus forwarded to him to Murrill Creek, some 17 miles from Mumbledool. The overseer distributed the fungus by dipping live grasshoppers into it and then liberating them to spread the infection. Mr. Gow adds that he was unable to inspect the results personally, but "so far as I can gather, it must have killed them pretty well."

At Narromine, Mr. W. N. Warren found, when he received the fungus, that all the grasshoppers "had been destroyed by bush swallows, which came on the scene in thousands, and cleaned them out in a few days."

Mr. Joseph Bishop, also of Narromine, tried the fungus in a small paddock, and in the vegetable garden, where it proved successful.

Mr. J. Quilliam, of Myall Plains, *via* Corowa, writes: "I cannot say I had any success in destroying grasshoppers with the fungus. I followed your directions, and used most of the liquid for dipping the hoppers, which I used to catch in a net where they were thickest, and after dipping liberated them as I travelled along in the buggy. The grasshoppers had attained a good size when I received the fungus, and had scattered all over the place. I would like to try the fungus again next year earlier, before the young grasshoppers scatter. This year feed was so scarce they scattered earlier than usual. The hoppers are a great pest here, covering such a vast extent of country, and are worse than drought and rabbits combined. You can understock and save paddocks for the summer, but the hoppers come along and eat everything, so that you are in the same position as if you were overstocked. I hope next year a systematic raid will be made on them here."

From Youngara, *via* West Wyalong, Mr. H. G. Laubenfeld writes: "Locusts were very numerous here for the whole month of July. On the night of the 31st of that month the thermometer registered only 14°—the severest cold I have recorded for over twenty years, and it seems that that night killed the locusts everywhere except in a few sheltered places. I had to search hard to find places to distribute the fungus, the damp breadcrumbs and bran and chaff being eaten so readily by rabbits. I therefore dipped as many locusts as possible. The fungus has been a great success; no locust reached the flying stage on my place, but I did not see any dead ones beyond an odd one, although birds showed that they got something extra in places where I put the fungus. I think I shall be free from the locust plague next year."

At Singleton, Mr. C. Doyle found that the locusts would not touch the infected bread and bran if they could get any grass to eat. Large flocks of ibis put in an appearance and eat the locusts in such numbers that Mr. Doyle is encouraged to think that if people would refrain from shooting these birds, their presence would result in extermination of the pest.

At Brotherong the drought was so severe that the locusts perished before any attempt to inoculate them with fungus could be made.

Mr. R. Whitehead, of Borambil, Forbes, states: "Again the trial was very unfavourable. Not only did the season come in exceptionally dry, but also the grasshoppers did not come to maturity on account of there being no grass. Those that were about were in a dormant state, were not travelling, and therefore in every way the conditions were unfavourable for a fair trial of the fungus treatment. I see the Victorians are having very successful results, and no doubt when the

## AGRICULTURAL SOCIETIES' SHOWS, 1903.

| Society. | Secretary. | Date. |
|---|---|---|
| Bega Agricultural, Pastoral, and Horticultural Society. | J. Underhill | Mar. 4, 5 |
| Braidwood P. and A. Society | G. F. Taylor | ,, 4, 5 |
| Liverpool A., H., and I. Society | J. E. Wilson | ,, 4, 5 |
| Tenterfield Intercolonial P. A. and M. Society | E. W. Hoskin | ,, 3, 4, 5 |
| Tenterfield Fair Days | ........... | ,, 6, 7 |
| Berrima District A., H., and I. Society | J. Yeo | ,, 5, 6, 7 |
| Bombala Exhibition Society | R. M. Cook | ,, 10, 11 |
| Campbelltown A., H., and I. Society | A. R. Payten | ,, 10, 11 |
| Central New England P. and A. Assoc. (Glen Innes) | Geo. A. Priest | ,, 10, 11, 12 |
| Quirindi District P., A., and H. Society | Geo. Naughton | ,, 11, 12 |
| Tumbarumba and Upper Murray P. and A. Society | J. J. McAlister | ,, 11, 12 |
| Port Macquarie and Hastings District A. and H. Society | J. Y. Butler | ,, 12, 13 |
| Nepean District A., H., and I. Society | E. K. Waldron | ,, 12, 13 |
| Goulburn A., P., and H. Society | J. J. Roberts | ,, 12, 13, 14 |
| Gundagai P., A., H., and I. Association | A. Elworthy | ,, 18, 19 |
| Blayney A. and P. Association | H. R. Woolley | ,, 18, 19 |
| Castle Hill and District A. and H. Association | R. H. Lalor | ,, 18, 19 |
| Inverell P. and A. Society | T. P. Borthwick | ,, 18, 19, 20 |
| Armidale and New England P., A., and H. Association (Armidale) | W. H. Allingham | ,, 18, 19, 20 |
| Camden A., H., and I. Society | C. A. Thompson | ,, 18, 19, 20 |
| Crookwell A., P., and H. Society | C. T. Clifton | ,, 19, 20 |
| Newcastle and District A., H., and I. Association | M. A. Fraser | ,, 19, 20, 21 |
| Castle Hill and District A. and H. Association | R. H. Lalor | ,, 20, 21 |
| Liverpool Plains (Tamworth) A. and H. Association | J. R. Wood | ,, 24, 25 |
| Gulgong A. and P. Association | G. E. Hilton | ,, 25, 26 |
| Orange A. and P. Association | W. Tanner | ,, 25, 26, 27 |
| Macleay A., H., and I. Association | E. Weeks | ,, 25, 26, 27 |
| Walcha P. and A. Association | S. Hargrave | ,, 31, April 1 |
| Cooma Pastoral and Agricultural Association | C. J. Walmsley | April 1, 2 |
| Mudgee Agricultural Society | Joseph M. Cox | ,, 1, 2, 3 |
| Upper Hunter P. and A. Association | C. Poppenhagen | ,, 1, 2, 3 |
| Royal Agricultural Society of N.S.W. (Sydney) | F. Webster | ,, 8 to 16 |
| Hunter River (West Maitland) A. and H. Association | W. C. Quinton | ,, 21 to 24 |
| Bathurst A., H., and P. Society | W. G. Thompson | ,, 22, 23, 24 |
| Dungog A. and H. Association | Chas. E. Grant | ,, 29, 30 |
| Wellington P., A., and H. Association | A. O. Rotton | ,, 29, 30 |
| Richmond River (Casino) A., H., and P. Society | E. J. Robinson | ,, 29, 30, May 1 |
| Wellington P., A., and H. Association | A. E. Rotton | ,, 29, 30 May 1 |
| Upper Manning (Wingham) A. and H. Association | W. Dimond | May 6, 7 |
| Clarence P. and A. Society | Jas. C. Wilcox | ,, 6, 7 |
| Lower Clarence Agricultural Society (Maclean) | Geo. Davis | ,, 12, 13 |
| Nyngan and District P. and A. Association | R. E. Burns | ,, 19, 20 |
| Cobar P. and A. Association | J. M. Scott | June |
| Narandera P. and A. Association | J. F. Willans | August 5, 6 |
| Albury and Border P., A., and H. Society | Walter J. Johnson | Sept. 9, 10 |
| Yass P. and A. Association | W. Thomson | ,, 10, 11 |
| Cootamundra A., P., H., and I. Association | T. Williams | ,, 16, 17 |
| Temora P., A., H., and I. Association | W. H. Tubman | ,, 29, 30 |

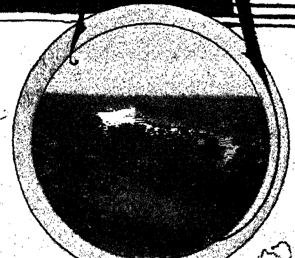
[One plate.]

VOL. XIV. PART 4. APRIL, 1903.

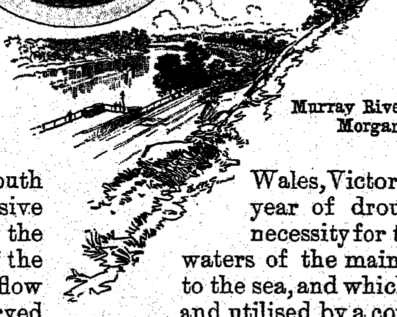
*Agricultural Gazette of New South Wales.*

# THE Murray Waters.

**Royal Commission inspecting Murray River Mouth.**



**The Murray River at Wigley's Flat, S. Australia.**



**Murray River at Morgan.**

THE question of the utilisation of the waters of the Murray Basin has been the subject of discussion for many years, and Royal Commissions have investigated the matter on several occasions on behalf of the individual States of New South Wales, Victoria, and South Australia. Each successive year of drought has directed attention to the necessity for the conservation and distribution of the waters of the main stream and its tributaries that now flow to the sea, and which, if properly and economically conserved and utilised by a comprehensive scheme of irrigation, would have an enormous effect in mitigating the losses which the pastoralists and landowners have suffered during the last few years.

Although New South Wales has had the first opportunity of availing itself of the waters of the rivers that flow through her territory, nothing of any consequence has been done in that State towards the utilisation of this valuable resource. On the other hand, Victoria has been engaged in irrigation enterprises for a number of years; and even South Australia, whose main interest would appear to be that of navigation, has authorised the diversion of considerable volumes of water at the irrigation colony of Renmark, and a number of village settlements along the banks of the Murray.

## Murray Basin.

It needs a considerable effort of imagination to realise the vastness of the drainage area within the Murray Basin. It covers an area of 414,253 square miles, or 265,121,920 acres, embracing 104,525 square miles of Queensland, 234,362 square miles of New South Wales, 50,979 square miles of Victoria, and 24,387 square miles of South Australia. The whole of New South Wales lying to the west of the Dividing Range, with the exception of about 15,000 square miles in the extreme north-west, is within the drainage area of the Murray. In Victoria the Dividing Range takes a course approximately east and west, and divides that State into two unequal portions, the larger being to the north of the range and within the Murray Basin. In Queensland the catchment area extends for about 250 miles northerly from the boundary of New South Wales, the principal tributaries being the Condamine and Maranoa, which unite and form the Balonne. The catchment area of the Murray in South Australia contributes scarcely a drop of water to the stream. A great and disappointing disproportion exists between the volume which reaches the Murray and the immense territory drained; only 158,000 square miles make any effective contribution to the flow, whereas 256,000 square miles is set down as non-contributing. The two great reasons for disparity between the area of the catchment and volume of flow are—(1.) The almost level character of most of the country, and (2) the rainfall over the flat deltaic area is distributed through so many days of the year that it is quickly absorbed, and very little water flows off. As an instance, it might be mentioned that the records of the Booligal district, extending over a number of years, show the average annual rainfall to be 12·24 inches, with an average of forty-four rainy days per annum. The following table shows the contributing and non-contributing areas in the four States in square miles:—

| | Contributing Area. | Non-contributing Area. |
|---|---|---|
| Queensland ... ... ... ... ... | 67,690 | 36,835 |
| New South Wales ... ... ... ... | 75,499 | 158,863 |
| Victoria ... ... ... ... ... | 15,310 | 35,669 |
| South Australia ... ... ... ... | Nil | 24,387 |
| | 158,499 | 255,754 |

On the lower portions of the Murray and Murrumbidgee, large areas are periodically inundated. The effect of this natural irrigation is that the carrying capacity of the flooded country is increased to an enormous extent. If rainfall to the extent of only 5 inches per annum over the immense catchment area of the Murray Basin actually reached the river, and making a liberal allowance for loss by evaporation and percolation, it would furnish sufficient water, at a moderate rate of flow, for a river seven times as wide as the Suez Canal, and 30 feet deep; and its annual discharge would be 3,097,600,000,000 cubic feet of water. This would at once settle the question of navigability, and allay the fears of the South Australians in respect to diversions by the upper riparian States for the purposes of irrigation.

## Murray River.

The head of the Murray is called the Indi River. It rises in the Snowy Mountains, and flows northerly along the base of the Snowy Range. At Bringenbrong it is joined by the Swampy Plain River, a stream of considerable importance, rising in the snow-clad ranges near Mount Kosciusko, where some of the peaks attain a height of more than 7,000 feet above sea level. Between Bringenbrong and Jingellic the Murray receives the Tooma, which rises in the Jagungal, Bogong, and Dargal ranges, where the country is rugged and precipitous, and heavily snowed for several months in the year. Towards Albury the Mitta and Kiewa join the Murray on the Victorian side. Between Albury and Wentworth the affluents of the Murray are the Ovens, Goulburn, Campaspe, and Loddon from the south, and the Murrrumbidgee and Darling from the north. The fall of the river is 9 inches per mile from Albury to Tocumwal, 7½ inches per mile from Tocumwal to Echuca, 4½ inches from there to Euston, 3¾ inches per mile to Wentworth, and from Wentworth to Lake Alexandrina the fall is under 3 inches per mile.

## The Corowa Conference.

In March of last year the Murray River Main Canal League, composed largely of farmers, and especially wheat growers in the neighbourhood of Berrigan and Finley, invited the Federal Premier and the Premiers of New South Wales, Victoria, and South Australia, and other representative men, including delegates from Renmark, Mildura, and the various Victorian irrigation trusts, to a conference at Corowa.

## Appointment of Royal Commission.

The result of the conference was the appointment of a Royal Commission to make full and diligent inquiry concerning the conservation and distribution of the waters of the River Murray and its tributaries for the purposes of irrigation, navigation and water supply, and to report as to the just allotment of the waters of the Murray Basin to the use of each of the States of New South Wales, Victoria, and South Australia.

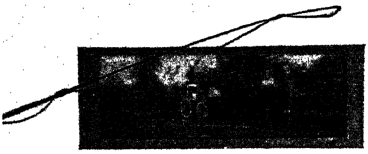
The report of the Commission, which has been issued, deals exhaustively with the question, and is undoubtedly the most complete and valuable contribution to the literature on the subject.

It is true that the Commissioners did not arrive at a unanimous decision on some vital points; at the same time they have furnished such information respecting the conflicting interests as to form a basis for a settlement that should be satisfactory to the States concerned.

It is a matter for regret that Queensland was not represented on the Commission, as over 100,000 square miles of that State is within the Murray Basin, and considerable interest is now being displayed in the subject of utilising the surplus waters by the Premier and Minister for Public Works of Queensland, these gentlemen having recently spent some time in inspecting the irrigation districts of Victoria and Mr. McCaughey's irrigation in New South Wales, with a view of carrying out a system of irrigation and water conservation in the Northern State.

## Itinerary of Royal Commission.

The writer has seen the itinerary of the Commissioners, which is an interesting one, and it is evident that a gang-forward policy was pursued in connection with its labours. The Commission, after taking departmental evidence in Sydney, Melbourne, and Adelaide, visited the Murray mouth, which is situated at the head of Encounter Bay. They then proceeded by the steamer "Tarella" through Lakes Alexandrina and Albert, and up the Lower Murray to Blanchetown which, owing to the low state of the river at that time, was the head of navigation. A long coach journey of about 500 miles was then undertaken, via Morgan, Overland Corner, Renmark, Lake Victoria, Wentworth, Mildura, Euston, Balranald, and Swan Hill. The Upper Murray was then visited, and sites for proposed storage reservoirs at Cumberoona, Talmalmo, and Thologolong examined. The taking of evidence and inspection of water conservation schemes, actual and prospective, in the Murray Basin within the State of Victoria, then engaged the attention of the Commission for a considerable time. In New South Wales, the Lachlan, Murrumbidgee, Darling, Bogan, Macquarie, and Murray rivers districts were visited. The Commission travelled about 20,000 miles, evidence was taken at sixty-three centres in the three States concerned, and during the course of the enquiry 294 witnesses were examined.



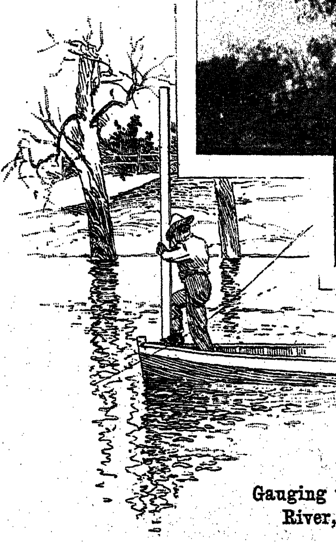
Royal Commission travelling, Lower Murray.

## GAUGING of the Murray and tributaries.

In a country like Australia, where the available supply of water is small compared with the demand, a knowledge of the quantity of water that may be relied on to be obtainable from any proposed source of supply, is an essential preliminary to the discussion of any scheme for diversion and utilisation. The quantity of water needed for irrigation is very great, and the area of irrigable land will always be in excess of the capabilities of the volume of water available. Hence it is most important to ascertain with precision what the volume really is, so that works of diversion and distribution may not be constructed in excess of the water that can be supplied.

The evidence tendered to the Commission should dispel the often expressed opinion that the State of Victoria contributes more largely to the flow of the Murray than New South Wales. On the Victorian side of the Murray the contributing area above Albury is double that of New South Wales, but the volume discharged by each State is almost equal, this being due to the fact that the New South Wales tributaries are fed from heavy deposits of snow which melt in the spring and early summer. The Murrumbidgee also discharges considerably more than the combined flow of the Ovens, Goulburn, Campaspe, and Loddon. The Darling, which is wholly within New South Wales, and whose waters are almost entirely at the disposal of South Australia, is a river of extremely irregular flow, yet in some years it can be relied on for a large accession to the flow of the Murray.

Ganging the Loddon River at Hollylocks Vic.



Gauging the Ovens River, Vic.

The following table shows the relative contributions to the main stream by the States of New South Wales and Victoria :—

| | High Year. | Low Year. | Mean Year. |
|---|---|---|---|
| | cubic feet. | cubic feet. | cubic feet. |
| N. S. Wales contribution ... | 1,010,000,000,000 | 424,000,000,000 | 293,000,000,000 |
| Victorian contribution ... ... | 446,000,000,000 | 255,000,000,000 | 153,000,000,000 |

The above figures are based upon the gaugings taken for a number of years at the point of affluence of the Murray with the several contributing streams.

In connection with the necessity for complete records, the Commission says:—

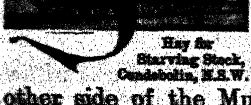
**Kow Swamp (Vic.) National Works, Regulator.**

In some river channels the total volume that flows down in certain winters is many times greater than in other winters. The discharge of the Wimmera at Glenorchy, for example is found to have been in one year nearly twelve times what it was in another year. The Goulburn also has discharged in one year nearly four times as much as in another year, while the Murrumbidgee in one year discharged seven times as much as it did in another, and the Darling ten times as much in one year as in another. All this points to the necessity for storing largely of the winter flow to provide for dry years, and also to the need of accurate and complete records. To this end, the officers entrusted with the measurements and observations should be expert surveyors and trained to the work.

The value of stream gauging increases with the length of time over which it is extended; and it is important that, here in Australia, there should be some uniformity of system both of observing and recording. This can only be attained by entrusting the work to one authority, or by proper concert among the States. A complete compilation of results of the gaugings of all the important streams that contributed to the flow of the Murray should be published periodically, and made readily available to the section of the public specially interested.

**Channel diverting from Broken River to Broken Creek, Vic.**

## Irrigation in New South Wales.



**Hay for Starving Stock, Condobolin, N.S.W.**

SEEING the immense benefits that have resulted from the application of water to the soil in other countries, it is little short of marvellous that there has been comparatively little development of irrigation in New South Wales. Whilst New South Wales has been slumbering on her rights, our neighbours on the other side of the Murray have been pursuing for years a vigorous policy of water conservation and irrigation, with the result that during the recent drought Victoria has suffered less than any of the other States, and has been able to supply large quantities of fodder to New South Wales.

Unquestionably, the prosperity of the State of New South Wales can in a large measure be ensured by a comprehensive scheme of irrigation, with large storage reservoirs at the head of the rivers to impound the flood and snow waters, and distribute them on the plains in times of scanty rainfall. The evil effects of the drought, which has brought ruin to numbers of settlers, would be lessened, and prosperity would be founded on a much sounder basis.

Nature favours the irrigation of the whole of the plains of New South Wales between the Murray and the Murrumbidgee, and the levels are suitable for the construction of canals on the north side of the Murrumbidgee, from Narrandera downwards. In two places—Hay and Wentworth—irrigation schemes were started some years ago, under authority of Acts of Parliament. The schemes, however, have met with little success in consequence of the irrigation areas not being altogether suitable for that purpose, and the settlers have also lacked the practical experience necessary for the successful working of small areas under intense culture.

The most successful irrigation in New South Wales has been carried on by individual landowners. Mr. Gatenby, of Jemalong Station, near Forbes, has 300 acres under lucerne and 100 acres under wheat, which he irrigates by pumping from the Lachlan. The soil is alluvial, situated on a bend of the river, and is particularly adapted for irrigation. By cutting the irrigated lucerne, Mr. Gatenby has proved that he can feed seventy-five sheep to the acre for four months in the year. The cost of irrigating this area is about £400 per annum, whereas to purchase and land fodder at Jemalong, in order to feed the same number of sheep that are provided for on the irrigated area, would cost Mr. Gatenby several thousands of pounds.

The Hon. Samuel McCaughey has demonstrated the wonderful productiveness of the land on the north side of the Murrumbidgee. His irrigation area at North Yanco is the most extensive in New South Wales. He has about 60 miles of channels, which are supplied in times of high river with water gravitating from an offtake on the Cudgell Creek, an anabranch of the Murrumbidgee. The river, however, did not rise sufficiently last year to provide a drop of water by gravitation, and Mr. McCaughey had to resort to pumping. By this means he has been able to irrigate 750 acres of lucerne and 250 acres of sorghum. He has an additional area of 1,500 acres under lucerne which he has not watered for over twelve months, yet he was able to graze fifteen sheep to the acre on this area for two months of last year. During a recent visit to North Yanco the writer had an opportunity of seeing the irrigated areas there, and it reminded one of an oasis in the desert, the surrounding land being parched and dry and almost denuded of vegetation, while the lucerne crop was a waving field of green. The sorghum is a particularly fine crop, from 6 to 10 feet high, and Mr. McCaughey intends shortly to commence cutting it. He estimates that he will be able to feed 15,000 sheep for a period of three months from this small area of 250 acres of sorghum. He also contemplates extensive fodder cultivation by laying down a large area under lucerne, and hopes, by irrigating this area, to raise and store sufficient fodder to avoid the necessity—generally attended with heavy losses—of sending sheep to the mountains.

There can be no question that what has been done at North Yanco can be accomplished with equal success on nearly the whole of the area between Narrandera and Hay, as the land is similar in character and levels such as will permit of the carrying out of large gravitation schemes. Portion of the land also is eminently suitable for intense culture, and, with proper tilth and a judicious application of water, summer fruits, olives, currants, sultanas and citrus fruits would grow to perfection.

With regard to the Murray, there is a large tract of country between Corowa and Finley, admirably fitted for irrigation, and which it is proposed to serve by a canal taking off at Bungowannah, as recommended by Colonel Home and Mr. McKinney. Towards Berrigan several of the large holdings have been cut up in areas of from 500 to 2,000 acres, and occupied by practical farmers, many of whom have had experience in irrigation in the Goulburn Valley. In the good seasons about ten years ago these settlers were attracted to Berrigan, as larger holdings could be obtained in that district than on the other side of the Murray. For a few years they had remarkably good crops, but the great drought has completely altered the results, and the Berrigan farmers would be glad to return to the small holdings on the Goulburn Valley where 1 acre under irrigation is more valuable than 10 acres without water. The land at Berrigan is if anything superior to that of Rodney, but the former is obtainable at £3 per acre whereas the latter is worth from £12 to £15 per acre. Naturally the Berrigan farmers are earnest advocates of the Bungowannah scheme, as it would not only provide sufficient water for a stock and domestic supply, but enable them to irrigate large areas of their holdings. The Bungowannah scheme is estimated to cost £550,000, and would provide a stock and domestic supply for 2,000,000 acres of land, and the irrigation of about 300,000 acres. The canals would command the land comprised in the districts of Corowa, Berrigan, Jerilderie, Finley, Conargo, Mulwala and Deniliquin.

## Irrigation in Victoria.

As showing the activity displayed by our Victorian friends in connection with the conservation and distribution of the waters of the Murray Basin, within the southern state, the map accompanying the report of the commission is instructive.

Where it has been possible to provide water for irrigation purposes, this has been done, but where the volume is inconsiderable, and not sufficient to provide for an adequate supply for irrigation purposes, the authorities have formed what are termed waterworks trusts, which supply water for stock and domestic purposes for the settlers. Altogether there are twenty-eight trusts, viz. :—Twenty-one irrigation

Irrigation in Victoria.

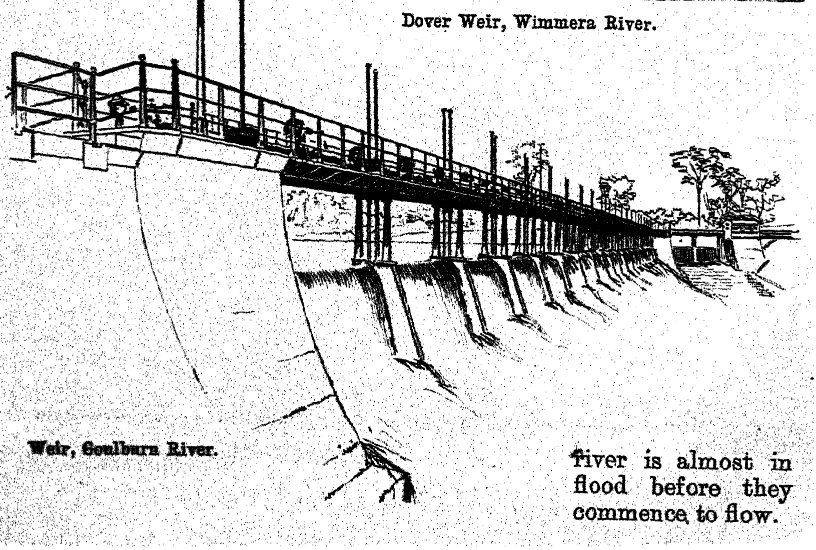
1. Inlet to Kow Swamp, National Works, Vic. 2. Coonooer Weir, Avoca River, Vic.
3. Flood Weir, Kow Swamp National Works, Vic.

trusts, and seven waterworks trusts. Although Victoria has been engaged in irrigation enterprises for the past eighteen years, and diversion schemes have been carried out on a somewhat comprehensive scale, the volume diverted annually is small compared with the immense quantity flowing to the sea. The total diversions only amount to 18,194 millions of cubic feet per annum, or one seventh of the volume allotted to her under the proposals of the Commission. It may safely be assumed that it will take at least ten years to divert a similar quantity, which, combined with the existing diversions, would be less than one third of Victoria's allotment. Many extraordinary statements have been made as to the effect of the diversions, and this is merely pointed out to show that what has been done has not in any way affected the question of navigability.

It is not to be assumed that because a channel is capable of diverting a certain quantity of water, that it will always be taxed to its utmost capacity, as the full supply will seldom be required, and would vary with the rainfall. Moreover, many channels take off at such heights that the river is almost in flood before they commence to flow.

Horsham Weir, Wimmera River.

Dover Weir, Wimmera River.



Weir, Goulburn River.

On the Wimmera, Avoca, Richardson, Loddon, Campaspe, Goulburn, and Broken rivers, many weirs and other works have been constructed for the conservation and distribution of the waters. A brief description of the principal works is taken from the report:

The Goulburn national works comprise a weir on the Goulburn River, 8 miles above Murchison, and 19¾ miles of main channel, with regulators, offtakes, &c. The weir raises the summer level of the river about 45 feet, and provides an available storage of 670,000,000 cubic feet for the channel. Its length over abutments, is 695 feet, exclusive of the head-gates, a further 230 feet. The waterway of the weir is occupied by twenty-one flood-gates, each 20 feet horizontally by 10 feet vertically in the clear. Each gate weighs 7 tons, and is worked by screw gearing, the motive power being obtained from the river itself. An electric lighting plant is provided for convenience of night-work during floods. The western channel has a bed-width of 110 feet, normal side-slope 1½ to 1, full supply-carrying depth 7 feet, and capacity of 103,000 cubic feet per minute. The proposed eastern channel has not yet been constructed. The Rodney irrigation, and the Echuca and Waranga waterworks, trusts are supplied from the western channel. The total cost of the works, so far, has been £465,000, of which £144,000 was paid for land compensation.

Kinypanial Weir, Loddon River.

Laanecoorie Weir, Loddon River.

The Loddon national works comprise a regulating reservoir on that river, about ½ mile above Laanecoorie, and two weirs for diversion, at Bridgewater and at the effluence of the Kinypanial Creek. The Laanecoorie storage is a compound structure, the portion in the river bed being an overshot weir of concrete masonry, with a row of wrought iron automatic gates (of the type invented by Chaubart) along the crest. The remainder is in the form of an earthen embankment. The length of the masonry weir is 320 feet, and of the earthen extension 700 feet. There are four 36-inch outlets, controlled by valves. The impounded water extends some 5½ miles up the river valley, the depth to the inverts being 32 feet, and the available contents, 610,000,000 cubic feet. The total cost of the work has been £133,000, of which £47,000 was for land compensation.

The Coliban works supply water for domestic, manufacturing, and mining purposes to the City of Bendigo, the boroughs of Chewton, Castlemaine, Eaglehawk, and Raywood, and the townships of Taradale, Fryers, Maldon, Huntly, and Sebastian, and water for mining, irrigation, and general purposes to the interjacent districts. The scheme includes two principal storage reservoirs on the Coliban River, one at Malmsbury, and the other about 10 miles higher up, with capacities of 3,337 millions and 4,093 millions of gallons respectively; a total of 7,430 million gallons, or nearly 1,190 millions of cubic feet. There are also 284 miles of main and branch channels, 25 subsidiary reservoirs and tanks with an aggregate storage capacity of 1,407 millions of gallons, 265 miles of mains and reticulation pipes, together with flumes, bridges, and other works. Both reservoirs are of earth, the lower 1,727 feet in length by 60 feet in maximum height, the upper 883 feet long and impounding a depth of 63 feet. The total debit to capital account of the Coliban Scheme is, at present, £1,132,000.

The Kow Swamp National Works are for the supply of water for irrigation to the Lower Loddon District. They comprise an in-take and regulator, at the effluence of Gunbower Creek from the Murray River, for diversion into a natural lagoon, known as Kow Swamp. The Gunbower itself and Taylor's Creek are utilised, as far as possible, as part of the channel of conveyance. The Kow Swamp reservoir is capable of storing 1,780 millions of cubic feet, available for summer use. A channel is also carried round the Swamp, from Taylor's Creek, to join the Macorna Channel, which issues from the storage at its north-western point; supply being thus available both from the Murray direct and from the storage. The Macorna Channel reaches the Loddon at a point about 12 miles south of the town of Kerang, crosses the river by a wrought-iron siphon, and terminates at a total distance from the Gunbower intake of 44½ miles. It has a carrying capacity of 10,000 cubic feet per minute. The inlet sill to the Gunbower Creek is at such a level that diversions take place only when the river is above full navigation level. The total cost of the works, including land compensation, has been £179,000.

Kow Swamp National Works, Box Creek Outlet and Channel from Swamp.

There are certain works now proposed in Victoria, in fact decided on, though not in detail, and already in their initial stages. The principal of these are:—The Waranga Basin, to store 7,500 millions of cubic feet of the waters of the Goulburn; a Main Channel westward from this storage, to serve the country as far as the Yarriambiac Creek,

**Margin's Hill Irrigation Trust Channel.**

**Kow Swamp National Works, Macorna Channel and Regulator.**

in the Mallee, and to supplement the supply to the Mallee; the Eastern Goulburn Main Channel, to provide an irrigation supply to the country included in the Shepparton and Numurkah Trusts; and a Storage Basin on the Wimmera River, to supplement the supply from Lake Lonsdale.

## Rodney Trust.

The most important Trust in Victoria is that of Rodney, which is situated on the western side of the Goulburn, and comprises an area of 277,545 acres. The water by which the area is irrigated is supplied from the Goulburn Weir, and there are about 700 miles of main and subsidiary channels. There are 600 irrigationists in Rodney who are engaged in a system of farming and intense cultivation, which has increased the field of labour, beautified their homes, and contributed in a marked degree to the freight income of the Goulburn Valley railway. During the great drought, when large areas of valuable country in New South Wales remain almost like a desert, the Rodney farmers are fattening stock for the Bendigo and Melbourne markets, and supplying the squatters of Riverina with lucerne and other fodder for their starving stock. Much improvement might be done in Rodney in connection with the grading of the land, and the farmers are beginning to realise that this is absolutely necessary in order to obtain the best results.

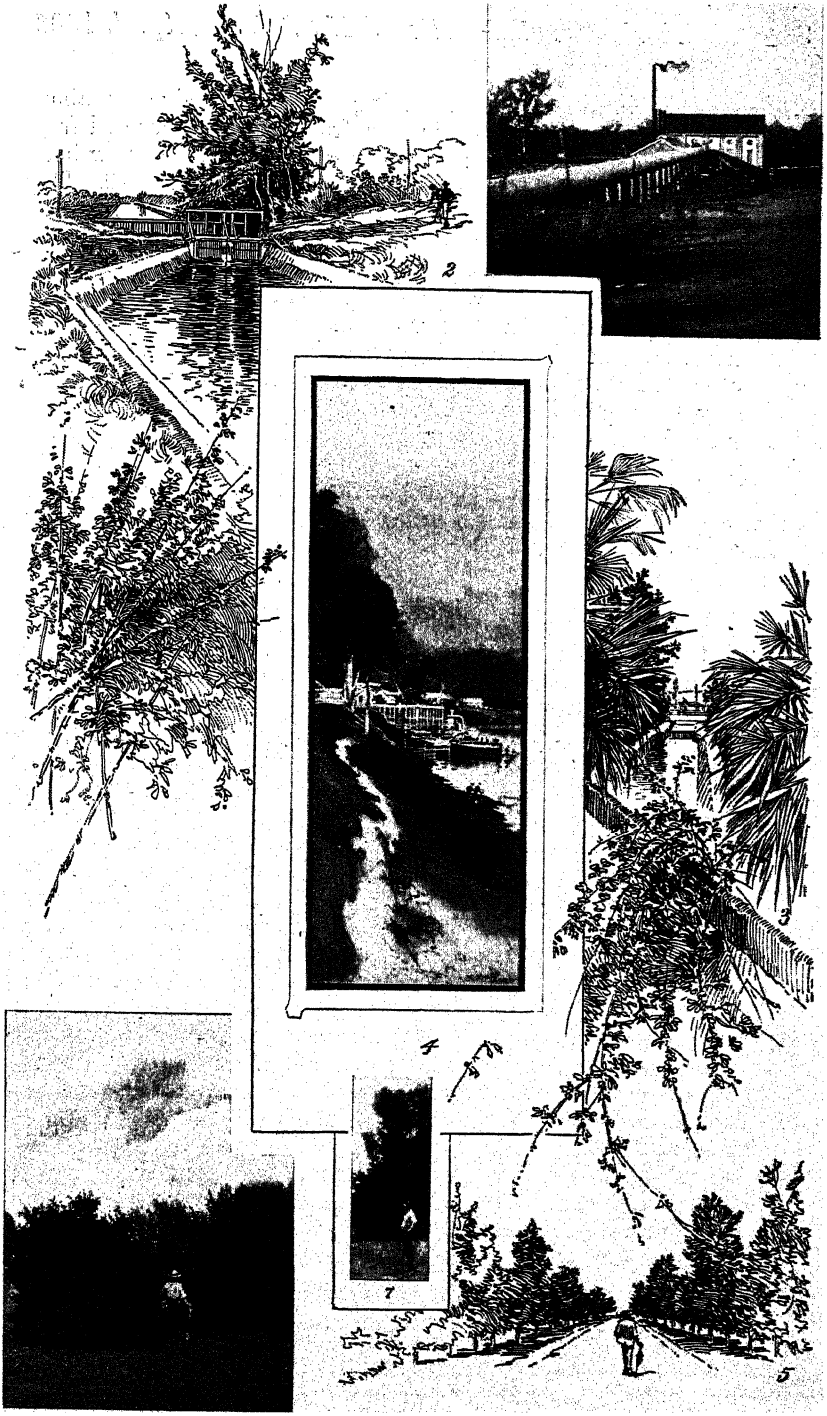
Experience in other countries has everywhere in modern times led irrigators to economy in the use of water, so that the supply has year by year become effective for a larger area than at first served. Even on land that, to the eye, appears almost perfectly adapted for the application of water there is often a good deal of grading and other preparation necessary to secure a beneficial result. The rougher land must be divided into small lots, by temporary banks thrown up with the plough. When water is turned upon uneven land, the lower portions receive too much before the higher are even covered; a matter about which some agriculturists are very careless, with the result that, not only is water wasted, but sometimes the land is injured instead of being benefited.

Irrigation has had a very marked effect upon the land values of the Goulburn Valley, as evidenced by the fact that where water is not obtainable land can be purchased for £6 per acre, whereas irrigated farm lands in Rodney are worth from £10 to £15 per acre, and orchard land has been sold at a very much higher figure.

## Mildura.

The Mildura Irrigation Colony is on the left bank of the Murray, about 16 miles by direct route above the junction of the Darling. It was founded in 1887 under an agreement between the Government of Victoria and the Messrs. Chaffey Brothers, conveying certain rights of land purchase, with authority to divert water from the river. The agreement was subsequently embodied in a special act of Parliament, and ratified by the Legislature. Messrs. Chaffey Brothers were authorised to divert from the Murray volumes varying with the season of the year, and limited in respect of the number of acres under irrigated culture. In the month of March, for instance, when the river is generally at its lowest, one cubic foot per minute was allowed for each twelve acres under cultivation; while, during September, October, and November, when the volume is usually greatest, it was increased to one cubic foot per minute for every four acres. The total area of the concession is 250,000 acres, the land in its virgin state being, practically valueless red sandy loam, covered with mallee and blue bush, with an average rainfall of less than 11 inches. It has been subdivided into agricultural blocks of 10 acres, suburban lots of 2½, and township lots of one-eighth acre.

In the early history of the settlement considerable dissatisfaction arose from the inability of the Messrs. Chaffey to fulfil the covenants into which they had entered; till at length, in consequence of their financial difficulties, the Government took over the works, and constituted a trust, with jurisdiction over 45,070 acres of the original concession, whereof 15,127 were sold land. The settlers, profiting by the mistakes of the past, are now utilising the soil to advantage and obtaining excellent results. Water is pumped from the Murray into channels at various levels, commanding an irrigable area of about 35,000 acres, whereof between 9,000 and 10,000 are under intense culture. The crops raised include raisins, sultanas, currants, apricots,



Irrigation in Victoria and South Australia.

1. Pumping station, Mildura. 2. Irrigation channel, Mildura. 3. Irrigation channel, Renmark.
4. Wharf at Mildura. 5. Avenue at Col. Morant's, Renmark. 6. The first Washington Navel
Orange-tree grown in Australia in Mr. Chaffey's orchard, Renmark. 7. Mr. C. Chaffey, Renmark.

peaches, and citrus fruits, representing an annual value of about £114,000. A considerable loss of water, from soakage, occurred from the 169 miles of channels when first constructed. This has now been in great part remedied by lining at an expenditure of £29,000. The Engineer of the Trust says that a further expenditure will be needed to place the whole in good condition. Mildura at present contains a population of about 4,000 and is in a fairly prosperous condition. The railway from Melbourne will be completed to the town by the end of June next, and will give command of the markets, not only of the metropolis, but of several large provincial towns. The capital value of the improved lands is given as £500,000; which fact, seeing that they were practically valueless without irrigation, affords an excellent object lesson of what can be accomplished by skilful cultivation and judicious application of water. Mildura and Renmark are notable as the only settlements in Australia which, as a consequence of the concentration rendered practicable by irrigation, can afford the advantages of town life.

## Renmark.

Much that has been said about Mildura applies equally to Renmark. Both colonies are on the red soil country of the Lower Murray, the conditions being similar in the two cases. The area of the Renmark concession is 250,000 acres; extending from the common boundary of New South Wales and South Australia, down the Murray, to the north bank of which it has a frontage of about 40 miles. In 1887 a beginning was made of the irrigation works, and the town of Renmark laid out, about 70 miles from Morgan, which is connected with Adelaide by rail. The license granted to the Messrs. Chaffey by the South Australian Government is identical with that granted by the Victorian Government in the case of Mildura. Here, also, owing to the failure of the promoters, the works were taken over, and a trust formed, with an area of about 12,000 acres. The works are similar in character to those at Mildura.

The value of the citrus and dried fruits, and olive oil, shows a steady yearly increase. The export in 1901 was £29,474, being an increase of £8,542 over the previous year. As an evidence of the value of irrigation it may be pointed out that Chowilla Station, adjoining Renmark, and containing 250,000 acres, is, owing to the drought, carrying only 5,000 sheep, whereas Renmark, with 3,000 acres under irrigated culture, maintains a prosperous population of 1,000 persons, living under agreeable social conditions. "Chowilla" is by no means destitute of country which under irrigation might be as productive as Renmark. The contrast simply emphasises the revolution wrought by irrigation.

Neither at Mildura nor at Renmark does the trust limit its constituents to the volumes of water conceded to the original licensees. The depth actually applied to the orchard lands of both settlements is 28 inches per annum, representing a volume so great as to inspire apprehensions of serious waste. If this volume really is required for fruit culture in the climate and soil of the Murray Valley, no time should be lost in amending the grants to the trusts; while the fact should be borne in mind in any future concessions proposed under like circumstances.

Notwithstanding the criticisms to which untoward circumstances have exposed them, the Mildura and Renmark settlements show the possibilities of the lands in the river valley, under a proper system of culture, in the production of nutritious, palatable, and wholesome food, in the support of a large industrial population, and in contributing to the trade and commerce of the States. Their experiences, however, have already begun to prove that the area of land suitable for the higher class of intense culture is limited by conditions not at first apparent. It is also showing that continuously cropping even the most suitable lands with any succession of the same kinds of crop—fruit, for example—must lead to the impoverishment of the soil, and to its reduction to an unfavourable condition of tilth. It is as necessary in fruit-growing as in any other kind of agriculture that there should be a rotation of crops.* This is pointed out by Dr. Jules Guyot in his well-known work on the cultivation of the vine, and is very apparent in the experiences of the Mildura and Renmark settlers.

## South Australian Village Settlements.

In 1894 the Government of South Australia set apart several areas on the banks of the Murray for the establishment of village settlements. Several methods of providing for the unemployed had been tried, with little result. The establishment of these settlements was regarded as an experiment, in the first place, to supply healthy employment; in the second, to utilise, by irrigation, the waste lands on the river banks. They were started on communistic principles; but owing to the lack of practical knowledge, and disagreements among the settlers, they have been by no means successful. Some have been entirely abandoned, while, in others, the original plan has been departed from. One was worked on the lines of the "New Australia" movement. This also proved a failure, and was closed in 1899. It is evident that human nature is not readily moulded to bring to a successful issue a settlement worked on the above lines.

## Navigation.

As the river traffic of the Murray and its tributaries is almost wholly controlled by South Australia, the question is one of great importance to that State. The question of irrigation is of much more vital importance to the States of New South Wales and Victoria, as it is only by the application of water to the land that the dry arid areas within those States can be made productive; and, if the land fronting the Murray is not made to produce, it seems to be useless to provide a permanent means of water carriage with nothing to carry. During the discussion in the debates of the Federal Convention, perhaps the most difficult question to solve was the "control of the rivers." The South Australian delegates fought for the absolute control of the rivers, and this was sternly resisted by the New South Wales and Victorian representatives. It was eventually agreed that the Commonwealth Parliament should have power to control trade and commerce between the States, which embraces the navigation of the rivers. It was furthermore agreed that "The Commonwealth shall not, by any law or regulation of trade or commerce, abridge the right of a State, or the residents therein, to the reasonable use of the waters of the rivers for conservation and irrigation," and a clause to this effect was embodied in the Commonwealth Constitution Act. The interpretation of the word "reasonable" will, probably, be a matter for the High Court to decide.

---

* Under the conditions of irrigation and intense culture the drain on the soil of its fertilising constituents is naturally greater than in cases where the soil is not called upon to produce crops so persistently. To make up for the rapid utilisation of the constituents of the soil, the irrigator must pay increased attention to the pruning of his trees, thinning of crops, and manuring of the land.

In most years the Murray is navigable to Wentworth for about seven months. For the last three, however, it has been navigable only about six months in each year. These years have also been unfavourable to navigation of the Darling, which, with the exception of a short distance near the Murray junction, has been practically non-navigable for the whole of that time. The Murrumbidgee may be regarded as navigable to Hay during certain months. A report of the New South Wales Public Works Committee, of 31st July, 1896, states, with regard to the Darling, that, for the fourteen years preceding, that river had been navigable for, on an average, half the year.

There are about ninety registered steamers plying on the river, and about the same number of barges; the largest barges having a capacity of about 300 tons.

It seems unlikely that the navigability of the river has been appreciably affected by anything done in the way of irrigation, either in New South Wales or Victoria. The volume diverted from the Murray in New South Wales for this purpose is at present practically nil; and, although some is diverted from the tributaries, as well as from the main stream, in Victoria, the total would have no sensible influence on the level of the river, or the duration of the period of navigation. An important factor affecting the duration of navigation has been the natural storage in certain lakes, a great part of which flowed out as the river sank, so maintaining its volume, sometimes for one to two months beyond that at which navigation would otherwise have ceased. Some of these natural storages are capable of improvement and regulation, their beneficial effect upon the navigability of the river being thereby extended.

South Australia is the natural outlet for a large proportion of the river-borne traffic, and, as before pointed out, it is largely in the hands of South Australians. The volume of this trade, however, far from increasing, has been seriously decreasing of late years. During the last two or three the condition of drought, prevailing throughout a large part of the country that furnishes the trade, may have had an important effect upon its reaching South Australia.

The extension of Victorian railways and differential rates to various points on the Murray has had still more to do with the decrease in the quantity of wool and other produce carried to Morgan, Murray Bridge, and Victor Harbour, and to a certain extent also the extension of the New South Wales railways to Hay, Bourke, and Brewarrina.

So far as the lower Murray ports are concerned, as well as Goolwa and Victor Harbour, the railway policy of South Australia itself bids fair to complete what New South Wales and Victorian railway competition has begun. At Victor Harbour, for instance, figures supplied show that for the four years up to 1901 the average number of bales of wool annually exported was 3,473; whereas the average for the preceding ten years was 10,499. Most of it came from the Darling, and although the drought has a great deal to do with the falling off, the diversion of trade by means of the railways to Murray Bridge and Morgan had also contributed. Murray Bridge is 61 miles from Adelaide, and Morgan 105; but the rates for river-borne goods are the same from both.

Those interested in the trade of the lower river are much concerned to see a scheme carried out that will have the effect of restoring the trade to what they regard as its natural outlet; a scheme by which the river boats will be able to tranship cargo to ocean-going steamers. Two have been proposed; one to render the Murray mouth navigable for ocean-going vessels, the other to cut a canal for river boats from Goolwa to Victor Harbour. The Murray mouth greatly resembles the entrances of the bar-bound coastal rivers of New South Wales, but its similarity to the Gippsland Lakes entrance, in Victoria, is still more striking. Many proposals have been made for rendering it navigable, but in view of large expenditure involved the schemes submitted have not been carried out.

## Amount expended by States in maintaining Navigation.

In connection with the maintenance of navigation, a sum of £368,479 has been spent in removal of overhanging and dangerous trees, reducing dangerous bars, and snagging of the Murray, Murrumbidgee, and Darling. Of this sum, £156,410 has been expended on the Murray, £87,772 on the Murrumbidgee, and £124,297 on the Darling. Of the total sum expended, the contribution by the various States is as follows:—New South Wales, £248,614; Victoria, £98,865; South Australia, £21,000. The figures show that the policy adopted by New South Wales cannot be regarded from a selfish standpoint, as it receives practically very little benefit from navigation, and has expended about a quarter of a million in its maintenance, or nearly twelve times the amount expended by South Australia, which derives all the benefits that accrue from the trade of the river.

## Locks and Weirs.

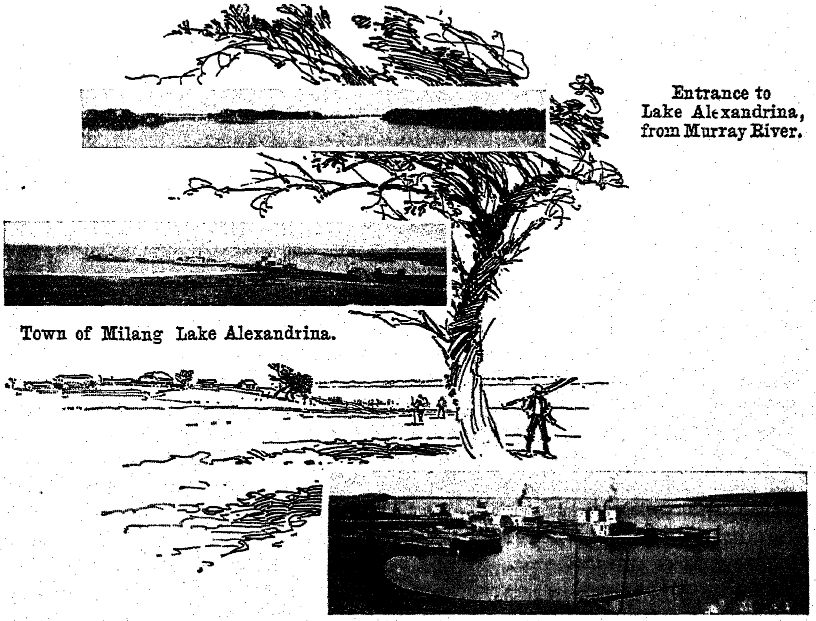
In rivers of such irregular flow as our main waterways, the only means by which permanent navigation can be ensured is by the construction of locks and weirs. Locking the rivers would raise the water level, and in many instances improve the facilities for irrigation, and in this respect it may be mentioned that if a lock and weir were constructed at Mildura it would save an expenditure in pumping of £2,500 per annum. It must be pointed out, however, that the mere locking and weiring of the rivers would not provide any additional water for diversion purposes—this can only be attained by the construction of storage reservoirs at the head of the rivers. The question as to whether the weirs should be fixed or movable has been carefully considered, and the departmental engineers of the various States are of opinion that the weirs should be movable, so as to allow free passage of flood waters. On the South Australian portion of the Murray, between Blanchetown and the New South Wales border, a distance of 230 miles Mr. Moncrieff, the Engineer-in-Chief for that State, estimated that six locks would be required, at a cost of £600,000. From the South Australian border to Echuca, which is 606 miles, Mr. Wade, the Principal Engineer for Water Supply in New South Wales, estimates that twenty locks would be required, at an estimated cost of £730,000. For locking the Murrumbidgee, from its junction with the Murray to Hay, a distance of 240 miles, it is considered that nine locks would be required, at an estimated cost of £321,750. With regard to the Darling, Mr. Wade states that the river could be made permanently navigable from Wentworth to Walgett, a distance of 1,187 miles, by constructing twenty-four locks, at a cost of £920,000. The estimated total cost for locking the Murray, Murrumbidgee, and Darling is £2,571,750. The Commission is of opinion that the traffic is not sufficient to warrant a complete system of locking. They, however, recommend that the Federal Government be invited to consider the desirability of carrying out the locking of the Murray, from Blanchetown to the junction of the Darling at Wentworth, at an estimated cost of £760,000. As to the question of canalisation, the engineers have come to the conclusion that it is not practicable, as the amount of silt deposited would necessitate constant dredging, which would involve an enormous annual expenditure in order to keep the channel open.

## Lakes Alexandrina and Albert.

Lakes Alexandrina and Albert, which are situated at the Murray mouth, comprise an area of 288 square miles, the former being 224 and the latter 64 square miles. The waters of the Murray discharge into Lake Alexandrina at Wellington, the outlet being through the Goolwa and Corrong channels, which unite at Mundoo Island, and form one channel to the sea. As stock are dependent on the lakes for water, the question of their freshness is important to the lakeside owners. The drought is responsible for the saltness of the lakes; but their present condition is by no means without precedent, for the Hon.

Alfred Catt, Chairman of Committees in the South Australian Parliament, remembers that in 1856, 1857, and 1858 they were so salt that the stock were unable to drink the water.

The Commission is of opinion that the proper course to maintain a supply of fresh water is the construction of a work at the outlet to exclude the sea, so designed as to discharge river floods over its crest.



**Entrance to Lake Alexandrina, from Murray River.**

**Town of Milang Lake Alexandrina.**

**Goolwa Harbour, Lake Alexandrina.**

The estimate for the construction of the barrage is £51,600. One fact in connection with the closing of the Murray mouth that cannot be overlooked is that the silt conveyed by the Murray waters will be deposited in the lakes, and, as they are comparatively shallow, the accumulation may be such as to seriously interfere with their navigability.

(*To be continued.*)

# Co-operation amongst Dutch Market Gardeners.

An interesting feature of the Dutch market gardening industry is the great extent to which co-operative principles have been applied to the sale of vegetables and fruit. All over North Holland the small market gardeners have formed societies for the joint sale of their produce, and in some districts they have erected their own auction halls. One of the largest of these associations is that known as the "Westland."

The Westland is a district between the Hague and Leyden, which is given up almost entirely to fruit-growing and market gardening. The usual size of the holdings is about 5 acres, though a few run to 10 acres and upwards. Rents are high, averaging about £5 10s. per acre, and when there are glass houses erected by the owner the gardener pays 5 to 8 per cent. yearly on the cost of erection. A short description of a market garden of 10 acres visited at Poldijk may serve as an example of the conditions existing in the Westland. In this case the occupier pays £5 17s. per acre rent, and he has ten glass-houses on his holding, for which he pays 5 to 7 per cent. on the cost of erection. These glass-houses cost 15s. 4d. to 17s. 10d. per lineal foot to build, or, when built against a wall, as is frequently the case, from 10s. to 12s. 4d. per foot. There is a polder tax of 13s. per acre on his holding, and the occupier also pays income tax. The soil is a clay loam, which the tenant has improved by the addition of sand brought from the dunes, and by heavily manuring it with horse-dung. On this holding large quantities of grapes, melons, tomatoes, cucumbers, peas, beans, pears, plums, early cauliflowers, endive, and strawberries are grown. The tenant works himself from early morning till night, and employs five labourers, to each of whom he pays 18s. a week. He keeps himself, a wife and five children on the profits from the sale of his produce, but his outgoings for rent, labour, and manure are so heavy that the standard of living of the family is necessarily a low one.

To men in this position it is important that their produce should be sold to the best advantage, and to secure this result it is recognised that the quality of the articles produced should be maintained at a high level, and that the middleman should be as far as possible eliminated. It is with these objects in view that the Dutch market gardeners have combined for the joint sale of their produce, through the agency of co-operative associations, of which the Westland Society is one of the most successful.

The object of the Westland Society, as set forth in its printed rules, is to promote the sale of market garden produce of the Westland by supervising the quality, quantity, and packing of the produce, by holding auction sales, by exporting goods of first-rate quality to foreign markets in order to direct attention to the character of Westland market garden produce, by improving the systems of cultivation, and by taking any steps which will further the disposal of the crops.

The society has a registered trade-mark in the form of a blue diagonal label, which each member is allowed to affix to the produce he brings to the auction; provided that the goods have been previously passed by the Committee, whose duty is to see that they are properly packed, that the contents of the packages, bags, or baskets agree with the weight stated on the label, and that the articles are sound and of good quality throughout.

The Westland Society consists of a federation of seven branches, five of which have erected their own auction halls with borrowed capital, while in two cases the auctions are held in hired buildings. Sales are held every night in summer, three times a week in the late autumn, and once a week in winter. These sales are largely attended by dealers and commission agents from Rotterdam, Amsterdam, the Hague and Delft, who arrange for the transport of their purchases to these towns, either for local consumption or for export.

Members of the society bring their produce to the auction hall in barges, and arrange their goods on the stands. When a large consignment of potatoes or other vegetables is offered for sale the purchase is made by sample, in other cases the dealer sees the entire lot of the article he buys. Each lot of produce to be put up for auction is entered on a delivery note by the member concerned, and this note is handed to the clerk, who subsequently passes it to the auctioneer. All goods purchased at the auction must be paid for in cash; credit is seldom given. A purchaser is also required to leave a deposit to cover the value of the sacks, baskets, or other packages.

The auctioneer is in each case the president of the branch society. He receives nothing for his services, as the post is considered one of honour. The only paid officer of the society is the clerk.

The funds of the society are derived from a yearly subscription of 1s. 8d. per member, and from a commission charged on the amount realised for the goods sold. In the case of what are known as large auctions, which include large consignments of potatoes, Brussels sprouts, beans, peas, gooseberries, and plums purchased by sample, the commission is fixed at 1 per cent., and for small auctions or sales of small quantities of fruit, cucumbers, and other produce, 2 per cent. of the sale price is deducted.

The sum realised by the sales is distributed at the end of each week amongst the members who have sent goods to the auctions, each receiving the amount for which his produce was sold, less the commission mentioned above.

In 1901 the value of the market garden produce sold through the agency of the auctions held by the seven branches of the Westland Society amounted to £44,250.

Associations of the type of the Westland Society, though on a smaller scale, are to be found throughout the market garden districts of North Holland. Several of them are in operation in the Districts of Alkmaar and Bovenkarspel, and the greater part of the cauliflower and cabbage crops grown in the neighbourhood of these places is disposed of by co-operative auction sales in buildings erected by such societies. The principal object of them all is to sell the produce of their members to the best advantage, and to maintain the reputation of Dutch produce for uniformity of quality by the inspection and and marking of goods offered for sale. Unsuitable produce is either rejected, or. if it is inadvertently passed by the examining committee, and a well-founded complaint is subsequently made by the purchaser, the producer is either compelled to take the goods back or to allow compensation to the purchaser on a scale fixed by the society. In the case of one co-operative auction mart near Bovenkarspel, a black board headed "Black List" is placed in a conspicuous position outside the mart, and on this the president of the society writes the name of any member who has endeavoured to pass inferior produce, and the name of any dealer who is in default with his payments.

At Bovenkarspel cabbages and cauliflowers are the principal products sold at the co-operative auctions. The mart is situated on the bank of the canal, and the auctioneer sits facing the dealers in a small shed built on piles in the canal. The barges with cauliflowers or cabbages pass between the auctioneer's shed and the main building.

It is claimed for this system of co-operation that it has largely reduced the commission and charges formerly paid to middlemen, that it has served to keep up the standard of quality of Dutch produce, and it has prevented the undercutting of prices which arises when individual producers compete against each other in the same market. Goods sold under the registered trademarks have an established reputation at home and foreign markets, and the enforcement of a high standard of quality by the marking committees has made it difficult for an individual to spoil the market for his fellow-gardeners by "topping up" inferior produce or by giving short weight.

As an instance of the business effects of such organisation as described in the above report from the Journal of the Board of Agriculture, it may be mentioned that the Dutch produce has been placed on the London markets in competitions so keen as to oust the English gardeners who formerly controlled the trade. In a report received through the Hon. H. Copeland, Agent-General for New South Wales, Mr. R. F. Crawford, of the British Board of Agriculture, describes the Dutch market-gardening schools which, with co-operation on the part of growers, are the factors responsible for the extraordinary advancement of the market-gardening industries of the Netherlands.

There is one State School of Horticulture and Market-gardening where students receive three years' instruction in all branches of horticulture and market-gardening. Then there are four state-supported winter schools. These winter schools are conducted under special regulations, the object being to enable persons who intend to take up market-gardening as a livelihood to obtain the necessary theoretical knowledge of the business at the lowest possible expense. The conditions of admission, age, educational attainments, &c., are very much the same as in the case of practical students at the New South Wales Experimental Farms. The fees are fixed by the Ministry of Agriculture, and must not exceed 33s. 4d. for the entire course of two sessions (*i.e.*, the winters of two years). There is, however, no accommodation for the residence of students.

# Analyses of Commercial Fertilisers in N.S.W.

F. B. GUTHRIE AND A. A. RAMSAY.

### 1903 List.

THE accompanying list of manures obtainable in New South Wales, together with their composition as determined by analysis, and their price, is the result of revision of the list issued in April, 1902. The list is compiled in the interest of the farmers; and it is hoped that it may serve as a guide to those requiring any particular class of manure. In every case the figures given are those obtained from samples submitted to the Department for analysis.

A word is necessary in explanation of the column giving the "values" of the manures. These figures are calculated from the composition of the manures as represented by analysis, a definite unit-value being assigned to each of the fertilising ingredients. The units on which the values here given are computed are as follows:—

UNIT-VALUES of fertilising ingredients in different manures for 1903.

| | Per unit. |
|---|---|
| Nitrogen in ammonium salts and nitrates... ... | 12s. 6d. |
| ,, in blood, bones, offal, &c.—fine... ... | 11s. 6d. |
| Phosphoric acid in bones, offal, &c.—fine... ... | 2s. 3d. |
| Potash in sulphate of potash ... ... ... | 5s. 2d. |
| ,, in muriate of potash ... ... ... | 4s. 6d. |
| Phosphoric acid in superphosphate and mineral phosphate— | |
| Water-soluble ... ... ... ... | 5s. |
| Insoluble ... ... ... ... ... | 2s. |

PRICE per lb. of fertilising ingredients in different manures for 1903.

| | Pence per lb. |
|---|---|
| Nitrogen in ammonium salts and nitrates ... ... | 6·7 |
| ,, in blood, bones, offal, &c.—fine ... ... | 6·2 |
| Phosphoric acid in bones, offal, &c.—fine ... ... | 1·2 |
| Potash in sulphate of potash ... ... ... ... | 2·8 |
| ,, in muriate of potash ... ... ... ... | 2·4 |
| Phosphoric acid in superphosphate and mineral phosphate— | |
| Water-soluble ... ... ... ... | 2·7 |
| Insoluble ... ... ... ... ... | 1·2 |

To determine the value of any manure the percentage of each ingredient is multiplied by the unit-value assigned above to that ingredient, the result being the value per ton of that substance in the manure. For example, a bone-dust contains 4 per cent. nitrogen and 20 per cent. phosphoric acid:—

4 × 11s. 6d. = £2 6s. = value of the nitrogen per ton.
20 × 2s. 3d. = £2 5s. = value of the phosphoric acid per ton.
£4 11s. = value of manure per ton.

It must be clearly understood that the value thus assigned, depending solely upon the chemical composition of the manure, does not represent in all cases the actual money value of the manure, which depends upon a variety of causes other than the composition, and is affected by local conditions. Neither does it represent the costs incurred by the manufacturer in the preparation, such as bagging, labelling, &c. It is simply intended as a standard by which different products may be compared. At the same time, it has been attempted to make the standard indicate as nearly as possible the fair retail price of the manure, and the fact that in the majority of cases the price asked and the value assigned are fairly close shows that the valuation is a reasonable one. To economise space, only those ingredients are given whose presence directly affects the value of the manures. Full analyses can be obtained if desired. In the fourth table are a number of waste products which may in many cases be economically utilised. The phosphoric acid in Thomas' Phosphate has been valued at 2s. 6d. per unit, which is about its value in England and on the Continent. The higher price at which it is sold locally is due to freight charges.

With regard to Part II (Bone-dusts, &c.), it will be observed that the state of mechanical division of these is given as "fine," "medium," and "coarse." "Fine" is the portion which passes through a sieve of 50 linear meshes to the inch, "medium" is the portion passing through a sieve of 12 meshes to the inch, but retained on the 50-mesh sieve, and "coarse" is the portion retained by the 12-mesh sieve.

The valuation has been made irrespective of the fineness of division, and is based on the amounts of fertilising ingredients only, but it must be borne in mind that finely ground bone-dust acts more rapidly than coarse, and that unground fragments of bone only become available as fertilisers very slowly.

When purchasing a manure always insist on a guarantee of its composition as determined by analysis.

Artificial manures should be mixed with about three times their weight of dry loam, and distributed evenly.

Never add lime to a manure containing sulphate of ammonia or blood and bone manures, as in these cases loss of nitrogen results; and when lime has been applied to the land do not use such manures until about three weeks afterwards.

## I.—SIMPLE FERTILISERS.

| Manure. | Where obtainable. | Nitrogen. | Equivalent to Ammonia. | Lime. | Potash ($K_2O$). | Phosphoric Acid. | Value. £ | s. | d. |
|---|---|---|---|---|---|---|---|---|---|
| Sulphate of Ammonia... ... ... | Australian Gaslight Co. ... ... .. ... | 20·70 | 25·13 | ...... | ...... | ...... | 12 | 18 | 8 |
| Nitrate of Soda... ... ... ... | Gibbs, Bright, & Co., 37, Pitt-street ... ... | 15·00 | ..... | ...... | ...... | ...... | 9 | 7 | 6 |
| Kainit ... ... ... ... .. | Australian Manures Co., 447, Pitt-street, Haymarket. | ...... | ...... | ...... | 13·81 | ...... | 3 | 11 | 4 |
| Sulphate of Potash ... ... ... | ,, ,, ... | ...... | ... .. | ...... | 49·25 | ...... | 12 | 14 | 7 |
| Muriate of Potash ... ... ... | ,, ,, ... | ...... | ...... | ...... | 56·59 | ...... | 12 | 14 | 7 |
| Nitrate of Soda... ... ... ... | ,, ,, ... | 15·00 | ...... | ...... | ...... | ...... | 9 | 7 | 6 |
| Sulphate of Ammonia ... ... ... | ,, ,, ... | 20·70 | 25·13 | ...... | ...... | ...... | 12 | 18 | 8 |
| Albert's Thomas Phosphate ... ... | ,, ,, ... | Fineness, 99·2 %. | | .. ... | ...... | 17·46 | 2 | 3 | 7 |
| Gypsum ... ... ... ... ... | ,, ,, ... | ...... | ...... | 93·72 | Crystallised $CaSO_4$ | | ........... | | |
| Kainit ... ... ... ... ... | Geo. Shirley & Co., 52 and 54, Pitt-street ... | ...... | ... .. | ...... | 14·88 | ...... | 3 | 16 | 11 |
| Muriate of Potash ... ... ... | ,, ,, ... | ...... | ...... | ...... | 59·76 | .. ... | 13 | 8 | 11 |
| Nitrate of Potash ... ... ... | ,, ,, ... | 13·58 | ...... | ...... | 45·40 | ...... | 20 | 4 | 5 |
| Sulphate of Potash ... ... .. | ,, ,, ... | ...... | ...... | ...... | 52·40 | ...... | 13 | 10 | 11 |
| Sulphate of Ammonia ... ... ... | ,, ,, ... | 20·70 | 25·13 | ...... | ...... | ...... | 12 | 18 | 8 |
| Nitrate of Soda .. ... ... ... | ,, ,, ... | 15·87 | ...... | ...... | ...... | ...... | 9 | 18 | 4 |
| Albert's Thomas Phosphate ... ... | ,, ,, ... | Fineness, 97·6 %. | | ...... | ...... | 17·78 | 2 | 4 | 5 |
| Gypsum ... .. ... ... ... | ,, ,, ... | .. ... | ...... | 83·51 | Crystallised $CaSO_4$ | | ........... | | |
| Lime ... ... .. ... ... | Sydney and North Sydney Lime and Cement Co., 279, George-street. | ...... | ..... | 95·00 | ...... | ...... | ........... | | |
| Agricultural Lime ... ... ... | ,, ,, ... | ...... | ...... | 82·12 | ...... | ...... | ........... | | |
| Kainit ... ... ... ... ... | Paton, Burns, & Co., Commercial Chambers, corner of Sussex and King Streets. | ...... | ...... | ...... | 14·20 | ...... | 3 | 13 | 5 |
| Sulphate of Potash ... ... ... | ,, ,, ... | ...... | ...... | ...... | 48·11 | .. ... | 12 | 8 | 8 |
| Nitrate of Soda... ... .. ... | ,, ,, ... | 15·48 | ...... | ...... | ..... | .. ... | 9 | 13 | 6 |
| Gypsum... ... ... ... ... | ,, ,, ... | ...... | ...... | 98·68 | Crystallised $CaSO_4$ | | ........... | | |

NOTE.—Lime, £1 per ton, and agricultural lime, 10s. per ton, on trucks at Portland. Agricultural lime is screenings from building lime, and is not slacked.

## II.—BONE AND BLOOD MANURES.

| Manure. | Where Obtainable. | Moisture, Volatile and Organic Matter. | Insoluble Matter. | Nitrogen. | Equivalent to Ammonia. | Phosphoric Acid. | Equivalent to Tri-calcic Phosphate. | Mechanical Condition. Percentage of— Fine. | Medium. | Coarse. | Value. £ s. d. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| "B.B." ... ... ... | Austral Freezing Works, Ltd., Royal Exchange. | 74·74 | 0·29 | 7·84 | 9·52 | 0·44 | 20·62 | 54·0 | 38·0 | 8·0 | 5 11 5 |
| Cophoni ... ... | ,, ,, ... | 47·88 | 0·50 | 5·19 | 6·30 | 22·43 | 48·98 | 48·0 | 41·0 | 11·0 | 5 10 1 |
| Bone-dust ... ... | Sydney Soap and Candle Co., 337, Kent-st. | 34·32 | 0·79 | 3·49 | 4·25 | 28·39 | 61·99 | 63·2 | 27·8 | 9·0 | 5 4 0 |
| Bone-char .. ... | Australian Manures Co., 447, Pitt-street, Haymarket. | 18·78 | 1·48 | 1·05 | 1·27 | 32·10 | 70·07 | 78·2 | 21·8 | Nil. | 4 4 4 |
| Bone-dust, green ... | ,, ,, ... | 42·19 | 2·45 | 4·78 | 5·80 | 23·24 | 50·74 | 16·8 | 46·0 | 37·2 | 5 7 3 |
| ,, steamed ... | ,, ,, ... | 42·78 | 5·37 | 3·78 | 4·59 | 22·41 | 48·92 | 38·6 | 39·0 | 22·4 | 4 13 10 |
| Bone and blood manure | ,, ,, ... | 56·54 | 1·30 | 6·62 | 8·04 | 18·08 | 39·48 | 14·0 | 74·8 | 11·2 | 5 16 10 |
| Blood ... ... ... | ,, ,, ... | 94·13 | 0·84 | 13·21 | 16·04 | ...... | ...... | 10·0 | 71·4 | 18·6 | 7 11 11 |
| Blood and bone, No. 1 | Geo. Shirley & Co., Pitt-st. | 55·84 | 1·05 | 6·66 | 8·09 | 18·02 | 39·35 | 23·8 | 65·8 | 10·4 | 5 17 1 |
| ,, ,, No. 2 | ,, ,, ... | 68·73 | 3·11 | 7·81 | 9·48 | 10·98 | 23·98 | 52·0 | 39·8 | 8·2 | 5 14 6 |
| A bone phosphate (char) | ,, ,, ... | 16·43 | 0·85 | 1·22 | 1·48 | 33·49 | 73·11 | 83·2 | 16·8 | ...... | 4 9 5 |
| Coarse bone phosphate | ,, ,, ... | 5·64 | 5·65 | ...... | ...... | 19·77 | 43·16 | 42·8 | 22·2 | 35·0 | 2 4 6 |
| Bone-dust, No. 1 ... | ,, ,, ... | 40·70 | 1·81 | 4·50 | 5·46 | 24·70 | 53·92 | 12·8 | 53·6 | 33·6 | 5 7 4 |
| ,, No. 2 ... | ,, ,, ... | 35·83 | 0·56 | 3·08 | 3·74 | 27·72 | 60·53 | 61·8 | 34·0 | 4·2 | 4 17 9 |
| ,, No. 3 ... | ,, ,, ... | 39·28 | 2·98 | 3·87 | 4·70 | 24·68 | 53·88 | 9·4 | 28·0 | 62·6 | 5 0 0 |
| Gee's fertiliser, B.B. ... | Sydney Meat Preserving Co., Rookwood and Auburn. | 72·67 | 0·78 | 8·85 | 10·75 | 10·43 | 22·78 | ...... | ...... | ...... | 6 5 3 |
| Bone-dust, extra fine ground. | Paton, Burns, & Co., Commercial Chambers, corner Sussex and King Streets. | 39·75 | 4·88 | 2·38 | 2·89 | 22·94 | 41·36 | 99·6 | 0·2 | 0·2 | 3 19 0 |
| ,, raw shank .. | ,, ,, ... | 35·80 | 0·47 | 4·31 | 5·23 | 28·07 | 61·28 | 12·0 | 36·6 | 51·4 | 5 12 8 |
| B.D. 1 ... ... ... | ,, ,, ... | 38·76 | 0·30 | 4·32 | 5·25 | 25·99 | 56·74 | 2·0 | 24·6 | 73·4 | 5 8 2 |
| B.D. 2 ... ... ... | ,, ,, ... | 40·26 | 1·85 | 4·64 | 5·60 | 24·48 | 53·44 | 46·0 | 42·4 | 11·6 | 5 8 5 |
| B.D. 4 ... ... ... | ,, ,, ... | 39·35 | 1·03 | 4·64 | 5·63 | 25·52 | 55·73 | 6·0 | 28·0 | 66·0 | 5 10 9 |
| B.D. 5 ... ... ... | ,, ,, ... | 32·60 | 0·67 | 2·94 | 3·57 | 28·45 | 62·11 | 53·8 | 35·6 | 10·6 | 4 17 10 |
| Bone-char ... ... | ,, ,, ... | 22·57 | 1·74 | 0·89 | 1·08 | 30·71 | 67·06 | 73·8 | 25·8 | 0·4 | 3 19 4 |
| B.B. (bone and blood) | ,, ,, .. | 57·38 | 1·49 | 6·88 | 8·35 | 17·32 | 37·81 | 46·0 | 49·4 | 4·6 | 5 18 1 |
| Bone-dust ... ... | M. O'Riordan, O'Riordan's-road, Alexandria. | 40·54 | 1·75 | 3·70 | 4·49 | 25·18 | 54·98 | 42·9 | 32·6 | 24·5 | 4 19 2 |

## III.—SUPERPHOSPHATES, MIXED FERTILISERS, AND IMPORTED FERTILISERS.

| Manures. | | Where obtainable. | Nitrogen. | Equivalent to Ammonia. | Water soluble Phosphoric Acid. | Total Phosphoric Acid. | Equivalent to Total Tri-calcic Phosphate | Potash. | Value. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | £ | s. | d. |
| Ohlendorff's Dissolved Peruvian Guano. | | Gibbs, Bright, & Co., 37, Pitt-street ... ... ... | 5·74 | 6·97 | 11·78 | 11·78 | 25·71 | 2·06 | 7 | 1 | 10 |
| Superphosphate ... ... | | Australian Manures Co., 447, Pitt-street, Haymarket | ... | ... | 20·51 | 22·06 | 45·34 | ...... | 5 | 5 | 9 |
| Superphosphate ... ... | | Paton, Burns, & Co., corner King and Sussex Streets | ... | ... | 16·52 | 18·82 | 41·09 | ...... | 4 | 7 | 2 |
| Superphosphate | No. 1 | Geo. Shirley & Co., 52 and 54, Pitt-street ... ... | ... | ... | 17·0 | ...... | 37·1 | ...... | 4 | 5 | 0 |
| | ** | ,, ,, ... ... | ... | ... | 12·5 | ...... | 27·3 | ...... | 3 | 2 | 6 |
| | 2 | ,, ,, ... ... | 1·80 | 2·19 | 14·8 | ...... | 32·3 | 1·23 | 5 | 2 | 10 |
| | 3 | ,, ,, ... ... | 3·45 | 4·19 | 13·1 | ...... | 28·6 | 2·83 | 6 | 3 | 3 |
| | 4 | ,, ,, ... ... | 5·26 | 6·39 | 11·5 | ...... | 25·1 | 3·71 | 7 | 2 | 5 |
| | 5 | ,, ,, ... ... | 3·23 | 3·93 | 12·0 | ...... | 26·2 | 7·00 | 6 | 16 | 7 |
| | 6 | ,, ,, ... ... | 1·01 | 1·23 | 13·3 | ...... | 29·0 | 6·3 | 5 | 11 | 8 |
| | 7 | ,, ,, ... ... | 1·98 | 2·4 | 11·4 | ...... | 24·9 | 1·00 | 4 | 6 | 11 |
| | 8 | ,, ,, ... ... | 3·81 | 4·63 | 9·05 | ...... | 19·8 | 2·00 | 5 | 3 | 2 |
| | 9 | ,, ,, ... ... | 3·78 | 4·60 | 8·97 | ...... | 19·6 | 4·00 | 5 | 12 | 9 |
| | 10 | ,, ,, ... ... | 2·85 | 3·46 | 9·13 | ...... | 19·9 | 7·01 | 5 | 17 | 6 |
| | 11 | ,, ,, ... ... | ... | ... | 11·36 | ...... | 24·8 | 7·00 | 4 | 13 | 0 |
| | 12 | ,, ,, ... ... | 3·03 | 3·68 | 5·5 | 15·03 | 32·81 | 1·97 | 4 | 14 | 7 |

### III.—SUPERPHOSPHATES, MIXED FERTILISERS, AND IMPORTED FERTILISERS—*continued.*

| Manures. | | Where obtainable. | Nitrogen. | Equivalent to Ammonia. | Water soluble Phosphoric Acid. | Total Phosphoric Acid. | Equivalent to Total Tri-calcic Phosphate | Potash. | Value. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | £ | s. | d. |
| Superphosphate | No. 14 | Geo. Shirley & Co., 52 and 54, Pitt-street ... ... | 2·12 | 2·57 | 5·97 | 13·44 | 29·33 | 6·56 | 5 | 5 | 2 |
| „ | 18 | „ „ ... ... | ... | ... | 5·5 | 14·6 | 31·9 | 6·00 | 3 | 16 | 8 |
| | 19 | „ „ ... ... | 3·88 | 4·72 | 4·1 | 15·9 | 34·7 | 1·86 | 5 | 2 | 2 |
| Bone Phosphate Series. | A | „ „ ... ... | 1·22 | 1·48 | ...... | 33·49 | 73·11 | ...... | 4 | 9 | 5 |
| | B | „ „ ... ... | 0·8 | 0·97 | ...... | 25·2 | 55·01 | 1·00 | 3 | 11 | 0 |
| | D | „ „ ... .. | 2·28 | 2·77 | ...... | 23·16 | 50·55 | 4·97 | 5 | 0 | 6 |
| | M | „ „ ... ... | 0·80 | 0·97 | ...... | 20·6 | 44·97 | 1·00 | 3 | 0 | 8 |
| | N | „ „ ... ... | 1·60 | 1·94 | ...... | 16·0 | 34·93 | 4·00 | 3 | 15 | 0 |
| | O | „ „ ... ... | 2·50 | 3·03 | ...... | 13·7 | 29·91 | 6·00 | 4 | 10 | 7 |
| "Australian Potash" | ... | „ „ ... ... | ... | ... | ...... | 5·02 | 10·96 | 17·00 | 4 | 19 | 2 |
| "Phosphate Potash" | ... | „ „ ... ... | ... | ... | ...... | 26·80 | 58·51 | 5·08 | 4 | 6 | 6 |
| Japanese Superphosphate. | No. 1 | Bowden Brothers & Co., Limited, 18, Bridge-street ... | ... | ... | 18·42 | 19·22 | 41·96 | ...... | 4 | 13 | 8 |
| | 2 | „ „ ... | ... | ... | 16·05 | 21·91 | 47·83 | ...... | 4 | 12 | 0 |
| | 3 | „ „ ... | ... | ... | 14·62 | 17·33 | 37·84 | ...... | 3 | 18 | 6 |

## IV.—WASTE-PRODUCTS, ASHES, &C.

| Manure. | | Where obtainable. | Water. | Volatile and Combustible. | Nitrogen. | Ammonia. | Insoluble. | Lime. | Phosphoric Acid. | Potash. | Val |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | £ s. d. |
| Deposit from wool-scouring tanks. | 1 | Liverpool Wool-scouring Works. | ........ | ........ | ·64 | ·78 | ........ | ........ | ........ | ·72 | 0 11 0 |
| | 2 | " " " | ........ | ........ | 1·02 | 1·24 | ........ | ........ | ·16 | ·39 | 0 14 0 |
| | 3 | " " " | ........ | ........ | 1·37 | 1·66 | ........ | ........ | ·14 | ·20 | 0 17 0 |
| Deposit from breakers | | " " " | 34·47 | | 1·81 | 2·20 | 50·68 | ·85 | ·88 | 1·60 | 1 10 10 |
| Sediment from wool-scouring works. | | Yass | 19·57 | | ·59 | ·71 | 78·24 | ·97 | .... | ·20 | 0 7 10 |
| Wool-waste | | ........ | ........ | ........ | 8·15 | 9·80 | ........ | ........ | ........ | ........ | 4 13 9 |
| "Skutch" from limed pelts | | Hugh Wright, Auburn | 5·32 | 73·42 | 1·80 | 2·18 | 3·61 | 9·30 | ·89 | ·20 | 1 3 6 |
| Decomposed hair and lime | | Fellmongery | 9·70 | 57·08 | 6·86 | 8·33 | 1·22 | 26·27 | ........ | ........ | 3 8 10 |
| Tan-yard refuse | | Tanneries, St. Mary's | 6·43 | 33·83 | 2·24 | 2·72 | 21·43 | 26·[illegible]6 | ·67 | ........ | 1 7 1 |
| Filter-press muck | | Cane-mills, Broadwater | 16·39 | 26·07 | ·22 | ·27 | 34·86 | 13·20 | *5·98 | ·44 | 1 11 8 |
| Megass | | Clarence River cane | 22·80 | 67·32 | ·63 | ·78 | 8·61 | ·30 | ·01 | ·05 | 0 7 6 |
| Megass-ash | | " " | ........ | ........ | ........ | ........ | 87·69 | 3·07 | ·16 | ·51 | 0 2 11 |
| " | | Richmond " | ........ | ........ | ........ | ........ | ........ | 1·11 | ·28 | 4·79 | 1 5 4 |
| Bloodwood-ash | | ........ | ........ | ........ | ........ | ........ | ........ | 8·47 | ·27 | 5·25 | 1 7 8 |
| Ironbark-ash | | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ·82 | 1·53 | 0 7 6 |
| Blackbutt-ash | | ........ | ........ | ........ | ........ | ........ | ........ | 7·27 | ·04 | 2·02 | 0 10 5 |
| Red-gum-ash | | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ·38 | 4·17 | 1 2 4 |
| Spotted-gum-ash | | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ·10 | ·70 | 0 3 10 |
| Boxwood-ash | | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ·67 | 1·65 | 0 9 3 |
| Seaweed-ash | | ........ | ........ | ........ | ........ | ........ | ........ | 0·27 | ·49 | ·59 | 0 4 0 |
| Sea-weed-ash | | ........ | ........ | ........ | ........ | ........ | ........ | 6·29 | 1·27 | 17·55 | 0 11 11 |
| Ash of grass-tree (*Xanthorrhœa arborea*). | | ........ | 0·80 | 1·78† | ........ | ........ | 33·48 | 24·94 | 3·07 | 5·30 | 1 15 0 |
| Vine-cuttings-ash | | ........ | ·49 | ........ | ........ | ........ | 60·64 | 11·34 | 1·85 | 3·76 | 1 3 2 |
| Red-apple-ash | | ........ | ........ | ........ | ........ | ........ | 54·52 | 14·96 | 0·47 | 6·00 | 1 12 0 |
| Ash of kerosene shale | | Hartley Vale | 1·49 | 27·93 | ·70 | ·85 | 67·59 | ........ | ·28 | ·14 | 0 9 4 |
| She-oak-ash | | ........ | ........ | ........ | ........ | ........ | 8·57 | 42·35 | 8·85 | 2·19 | 0 13 0 |
| Sea weed fresh state | | ........ | 80·00 | ........ | ·10 | ........ | ........ | ·41 | ·09 | 1·18 | 0 6 6 |
| Sawdust | | ........ | 32·52 | 62·35 | ·82 | 1·00 | ........ | ........ | 1·70 | ·05 | 0 10 3 |
| Cave-deposit, shells, &c. | | Cowan, Hawkesbury River | 2·11 | ........ | ·82 | ·90 | ........ | 35·40 | 1·59 | ·88 | 0 17 2 |
| " | | Macleay River | 23·06 | 16·01 | 2·43 | 2·95 | 26·77 | 13·88 | 7·40 | ........ | 2 2 9 |
| Gypsum | | Marulan | | (Crystallised $CaSO_4$=92·64.) | | | 4·47 | ........ | ........ | ........ | .... .. |
| Flue-deposit | | Maitland | ........ | ........ | ........ | ........ | 83·75 | 2·56 | ·32 | ·31 | 0 1 9 |
| " | | Liverpool | ........ | ........ | ........ | ........ | 91·17 | ·42 | 1·29 | ·17 | 0 3 5 |
| " from sanitary furnace | | ........ | ........ | ........ | ........ | ........ | 63·53 | 6·64 | 1·82 | 1·61 | 0 11 11 |

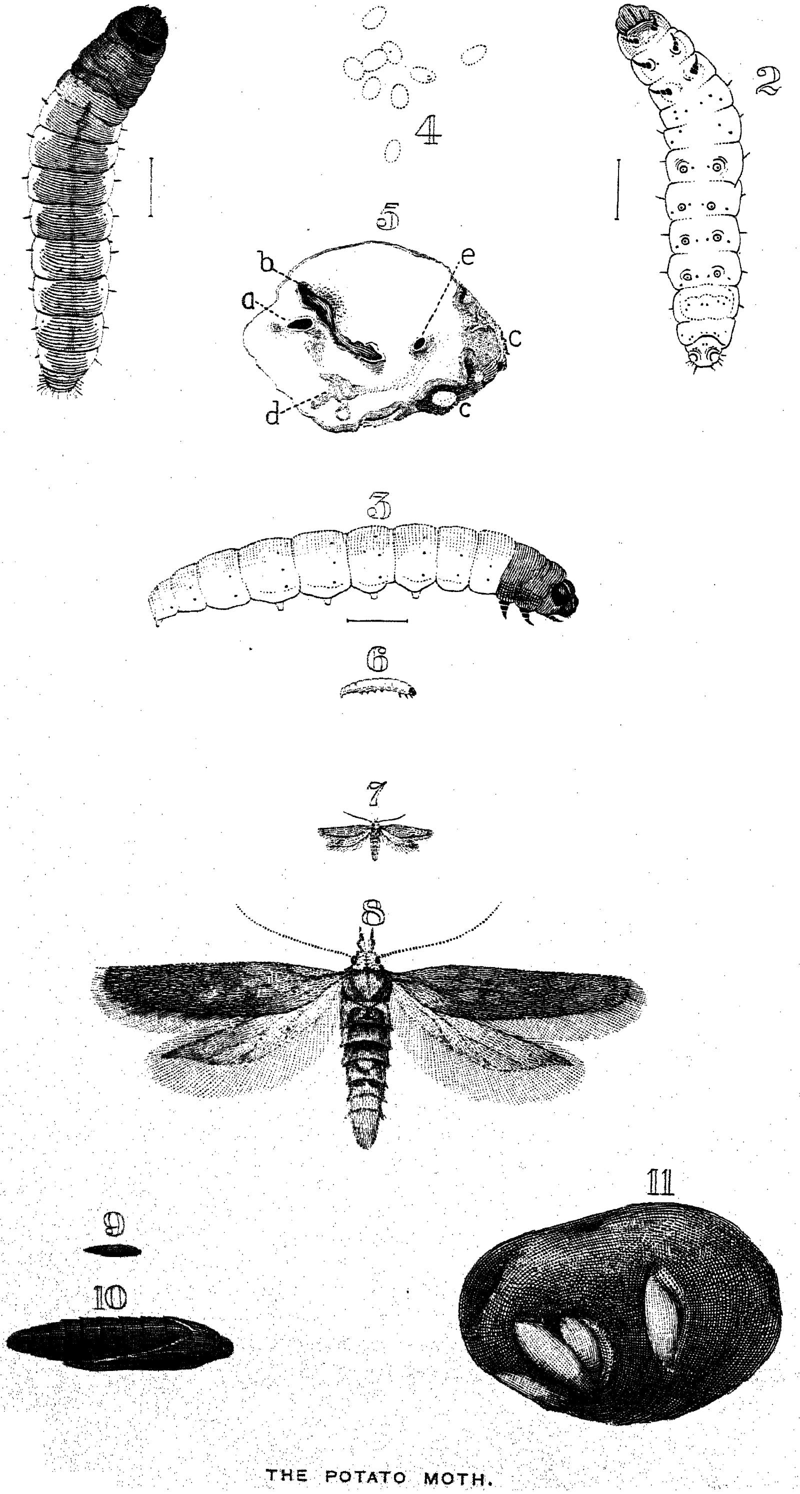
* 5 per cent. soluble in water. † Unburnt carbon.

## IV.—Waste-Products, Ashes, &c.—*continued.*

| Manure. | Where obtainable. | Water. | Volatile and Combustible. | Nitrogen. | Ammonia. | Insoluble. | Lime. | Phosphoric Acid. | Potash. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | £ s. d. |
| Night soil mixed with lime .. | .................. | 44·33 | | ·74 | ·80 | 18·00 | 27·62 | ·78 | .... | 0 10 0 |
| Night-soil .. .. .. .. | Wagga Wagga .. .. | 6·70 | | ·03 | 0·4 | 82·19 | ·44 | ·28 | ·69 | 0 4 6 |
| " .. .. .. .. | " .. .. | 9·14 | | ·28 | ·34 | 78·92 | 1·18 | ·18 | ·54 | 0 6 4 |
| " .. .. .. .. | " .. .. | .... | | ·50 | ·61 | .... | .... | ·64 | ·62 | 0 10 2 |
| " preparation, No. 1 .. | " .. .. | 8·22 | | 3·73 | 4·63 | 50·22 | 13·32 | 9·65 | ·91 | 4 1 6 |
| " " No. 2 .. | .................. | 7·20 | | .... | .... | 29·02 | 6·05 | 4·10 | ·15 | 1 19 1 |
| " " No. 3 .. | .................. | 25·95 | | 1·64 | 1·99 | 60·17 | 1·39 | 1·61 | ·70 | 1 6 6 |
| Night-soil preparation, "Pinhoe" manure. | .................. | ·92 | 9·54 | ·21 | ·25 | 57·58 | 14·71 | 1·26 | ·56 | 0 7 10 |
| Night-soil preparation, No. 1 .. | F. Artlett, Parramatta .. | 7·33 | 30·06 | 2·10 | 2·55 | 46·38 | 3·74 | 1·92 | ·61 | 1 11 2 |
| " " .. | " " .. | 10·11 | 42·59 | 4·97 | 6·03 | ·94 | $CaCO_3$ 30·12 | ·39 | ........ | 2 17 11 |
| " " .. | Mr. Halstead, O'Brien's patent. | 1·54 | 12·36 | ·54 | ·65 | 77·95 | ........ | ·63 | ........ | 0 7 6 |
| Farmyard-manure .. .. .. | .................. | 67·06 | 22·09 | ·40 | ·40 | 8·16 | ·16 | ·20 | ·30 | 0 6 6 |
| Fowl-manure .. .. .. | .................. | 3·95 | 16·48 | 1·47 | 1·78 | 70·16 | 2·10 | 1·94 | ........ | 1 7 11 |
| " .. .. .. .. | .................. | 1·54 | 15·23 | ·86 | 1·04 | 79·93 | ·64 | ·59 | ·33 | 0 12 9 |
| Flying-fox-manure .. .. .. | .................. | 1·09 | 35·34 | 3·34 | 4·05 | 50·29 | 1·02 | 0·36 | 1·15 | 2 5 2 |
| Fish-manure .. .. .. .. | .................. | 10·[illegible]8 | 59·26 | 6·10 | 7·40 | 5·39 | 9·82 | 8·28 | ........ | 4 8 9 |
| Sheep-manure .. .. .. | Liverpool Wool-scouring Works. | 9·71 | 50·91 | 1·79 | 2·17 | 32·26 | 2·0 | ·91 | ·92 | 1 7 2 |
| Bat-guano .. .. .. .. | .................. | 14·11 | 17·69 | 1·55 | ·88 | 28·77 | 13·72 | *11·42 | ........ | 2 3 8 |
| Bat-guano† .. .. .. .. | .................. | 10·86 | 19·65 | 2·24 | 2·72 | 51·95 | 1·75 | 3·55 | ·15 | 2 2 7 |
| Bat-guano‡ .. .. .. .. | .................. | 13·70 | 34·35 | 4·76 | 5·78 | 3·30 | 22·28 | 13·04 | trace | 4 0 10 |
| Bat-deposit .. .. .. .. | Cave Flat, Cooradigbee .. | 5·43 | 12·98 | ·50 | ·61 | 57·64 | 5·60 | 12·12 | ........ | 1 9 11 |
| Decayed wood (bark and leaves), bloodwood. | .................. | 67·80 | | ·74 | ·80 | 40·68 | 1·30 | .... | .... | 0 8 6 |
| Decayed wood (bark and leaves), pepper tree. | .................. | 79·92 | | ·89 | 1·03 | 17·77 | 1·50 | .... | .... | 0 10 2 |
| Muck from waterworks reservoir | Maitland .. .. .. | 4·84 | 17·55 | ·74 | ·90 | 63·42 | 4·56 | ·31 | ·60 | 0 11 0 |
| Cocoa-nut cake .. .. .. | Lever Brothers .. .. | 8·71 | 85·37 | 3·45 | 4·15 | .... | 1·40 | 1·23 | 2·45 | 2 14 10 |
| Bean-cake .. .. .. .. | North China .. .. | 14·52 | 80·32 | 6·77 | 8·22 | .... | .... | 1·33 | 1·99 | 4 10 10 |
| Field-pea, whole plant .. .. | .................. | 88·58 | 9·97 | ·55 | ·67 | .... | ·15 | ·12 | ·49 | 0 9 1 |
| Tares, whole plant .. .. .. | .................. | 83·97 | 14·96 | ·73 | ·88 | .... | .... | ·11 | ·21 | 0 9 8 |
| Marsh-mallow, whole plant .. | .................. | 79·00 | 17·86 | ·85 | 1·03 | .... | .... | ·14 | ·69 | 0 13 7 |

---

* 1 per cent. of the phosphoric acid is water-soluble. † The total nitrogen contains 1·12 nitric nitrogen, ·84 ammoniacal nitrogen, ·28 organic nitrogen. ‡ This analysis was made by Mr. J. C. H. Mingaye, and the total nitrogen contains 1·70 nitric nitrogen, ·64 ammoniacal nitrogen, and 2·42 organic nitrogen.



THE POTATO MOTH.

# The Potato Moth (*Lita solanella*, Boisd.).

By WALTER W. FROGGATT, F.L.S.
Government Entomologist.

AMONG the many pests that attack the potato, this is certainly one of the most wide-spread; for though there are others, such as the Colorado beetle, that in its native land does more extensive damage locally, yet this little brown moth, from its habits, can be so easily transported from place to place in seed potatoes, old bags, and packing, that it is only a question of time when it will have probably followed the potato all over the world. At present it is unknown in England and the greater part of Europe, and is only a slight pest in a section of the United States. Meyrick suggests that it would not become a pest in any temperate climate where cold wet winters were the rule, but as it is so well-known in New Zealand and Tasmania this does not seem to hold good as regards climate.

Though this potato pest was recorded from Tasmania as far back as 1854 by Captain Berthon, it was not described or given a name until Boisduval bred a specimen from potatoes grown in Algeria in 1874; but I have been unable to consult his article, which was published in a French horticultural journal, and, like previous writers on the subject, have had to go to Ragonot's paper on Boisduval's description, published in the following year in the bulletin of the Société Entomologique de France. Meyrick gives an interesting account and description of this moth in a paper on "A Micro-Lepidopterous Insect destructive to the Potato," published in 1880, which is the first record of it in this country; but according to notes he received from Macleay, it had been well known among the potato-growers of the Hunter River district for some years; and this, or a closely allied species, had been recorded from the Shoalhaven to as far south as Melbourne. In 1882, Tepper gave his experiences with the potato moth in South Australia, where it had been a well-established pest for some years. Tryon described its distribution and habits in southern Queensland in his "Report on Insect and Fungus Pests, 1889," and in 1892 Olliff recorded it in this *Gazette* as also attacking the tobacco plants in the Tamworth district.

French wrote an article in the second part of his "Handbook of the Destructive Insects of Victoria," in 1893, illustrated with a coloured plate. In 1894 Kirk published a leaflet to farmers on the potato moth, in which he states that Mr. Allen Wright, of Poeroa, considers *Lita solanella* to be a native of New Zealand, and wrote to him—"that it formerly fed largely on the bullrush or raupo (*Typha angustifolia*), and as this was used for thatching potato houses, the insect soon discovered that the tubers were more to its liking." Kirk, however, says that it was certainly introduced at a very early date, probably from Tasmania, and, owing to want of its natural food, has taken to other plants, as he had found it thrive on a native Solanum, which belongs to the same natural order of plants as the potato and tobacco. As there are about 600 different species of Solanum described, and they are hardy plants that are widely distributed over the world, this is another factor in the spread of this destructive little moth; and in Meyrick's notes he points out that, "if it is a native of Algeria, its native food plant is, probably, some wild solanum," just as the original food-plant of the "potato bug," or Colorado beetle, was the wild sandburr on the Rocky Mountains. Until 1891 there was no notice of this insect having been found in America, when Messrs. Riley and Howard, in an illustrated article on insect life, stated that it had been found in California the season before. This article provoked a number of newspaper comments in California, several growers writing to say that it was no new pest, but had been known for many years in that State; but if that were the case, it had never been brought under the notice of an entomologist.

At the present time it is a well-established pest in this State, and is more or less in evidence every season, though it appears to be generally worse after a dry winter. This season it has destroyed a great number of potato crops in the Windsor district, and one of the reasons is that, owing to the crops being so poor last year, the potatoes were not dug up but left in the ground or turned over in the field, so that there was an abundant supply of food for the little moths to infect with their eggs, which produced the swarms coming out this season.

When the plants were growing and looking very well the warm weather brought the wintering brood of moths out from the infested potatoes left over from the last year, and they immediately settled upon the foliage and laid their eggs, the tiny caterpillars feeding upon the foliage, and afterwards gnawing their way down the centre of the stalks, generally entering at the base of a leaf-stalk in junction with the main branches, and when full-grown pupating in a loose silken bag among the wilted tops.

The moths that come from this brood hide among the foliage, flying out in regular clouds where the plants are badly infested, and immediately dropping down among the clods of earth to hide, their light brown colour being so much in harmony with the surrounding soil that they are very difficult to detect. I do not think that the grubs feeding upon the potato tops ever reach, except by accident, the tubers beneath, but that the potatoes are infested in the field after they are dug up or in the farm sheds after they are gathered in and stored. In every case where a tuber has been exposed by the weather, if the moths are about it will be found worm-eaten, and, of course, in some soils which crack and open in dry weather, the moths will sometimes crawl down if tubers are near the surface, but the delicate structure of the moth stops it from going underground except down a well-defined opening. There are, therefore, two well-defined infestations by the potato moth; the first from the winter brood, coming forth when the tops are growing and ruining the crop by killing the foliage; and the second when the moths from this brood lay their eggs upon the potatoes themselves, either in the field or after they are stored.

In the first case the greatest preventive is to see that all rubbish, tops, small potatoes, and old bags, packing and such like, are boiled or burnt, to destroy the larvæ and pupæ of the pest before the perfect egg-laying moth appears. Where practicable, never plant potatoes in ground that has produced wormy ones the previous season, so that the pest will be starved out from want of food. Never plant wormy seed; all seed potatoes could be easily washed, and if the bags containing them were submerged in a tank, or barrel of water, the bulk of the caterpillars would be killed; and lastly, where the moth is suspected to exist, plant the seed deep and keep them well covered. The potatoes should never be left exposed in the field; Captain Berthon gives an instance (in his original paper on the pest in Tasmania in 1854) that, not knowing the habits of the pest, he exposed all the potatoes in a field, where he left them for a couple of days, and when he came to examine them found nearly every potato infested from the underside by the eggs or young grubs. If the crop is carefully stored away there is not much danger of it becoming infested, but where, as in many instances, they are carted in or emptied out loosely in the shed, the moths very soon appear and deposit their tiny eggs upon the eyes of the potato, and it is very soon worthless and a centre of infection for all the surrounding tubers.

It therefore appears that the most rational methods are preventive ones, keeping the moth out of the land and out of the store-rooms.

When first interested in the question, I carried out a number of experiments by dipping the sets in various mixtures before planting, but the virtue had gone out of them long before the moths appeared. Tar water has been recommended by several writers, to spray over the plants to keep the moth from coming near, but the instinct that draws the mother to the only food-plant fit for her babies would also enable her to find some unsprayed foliage. In the earlier stages, when the foliage is first infested, spraying with Paris green, as for codlin moth, would probably kill a number of the little grubs before they could burrow into the stalks.

The moth was described by Boisduval under the name of *Bryotropha solanella*, but has since been placed in the allied genus *Lita*, which contains several other species of these small *Tineina* that have very similar habits; "a closely allied species, *Lita epithymella*, Stg., feeds in the larval state upon *Solanum nigorum*, but in a different mode, by mining in the leaves," and differs in structure "by the much longer terminal joint of the palpi" (Meyrick).

The *moth* measures about seven lines across the outspread wings, so that it is not a conspicuous object in the field.

The general colour of the moth is greyish-brown, with a silvery buff tint, but the shades of brown vary very much in different broods and specimens. The forewings are darkest mottled, with blackish scales most noticeable at the tip of the wings, the apical portion of the hind margin and tip clotted with a fringe of fine hairs; the hind wings of uniform, much lighter colour, with the fine long hairs forming a fringe round from the apex of front margin to the base of the hind ones, which is much deeper than the width of the wing itself.

The front of the head is pearl grey, the body long and slender, legs unequal in length, the front ones being shortest, the middle pair and the posterior pair very long, the tibiæ being clothed with stout long hairs, and bearing a double pair of long spines; tarsi long; the whole of the legs distinctly mottled with darker brown.

Tepper notes the moths bred in captivity coming out of the chrysalid state in the end of December; they were very plentiful about this date at Windsor, but this was our second brood, whose larva would look for the tubers. As previously noted, the eggs are either deposited upon the leaves and stalks, or later on upon the ripe potato.

*The Caterpillar.*—When full-grown, the caterpillar measures slightly under half-an-inch in length, and is long and slender in proportion, tapering towards the tip of the abdomen. The general colour is dull white, slightly tinted with pink, with the upper surface of the head and first thoracic segment brown. The legs are brown, slender, with the pro-legs on the abnominal segments distinct, and the dorsal surface lightly clothed with scattered hairs. When full-grown, they form a loose silken bag, and generally pupate close under the skin of the tuber protected by the gnawed debris surrounding them.

The *pupa* is of a bright yellow colour, later on turning to a darker tint, and measures under the third of an inch in length, rounded at the head, and tapering to the tip of the abdomen.

The following letters have been received from correspondents with regard to their practical experience with Potato Moth:—

Mr. A. Collard, Berry Park, Morpeth, writes:—"I have known the potato grub ever since a lad, some thirty years ago. In those days there were none of the earlier varieties of potatoes grown, such as Early Rose or Vermont; it was mostly Circular Head. I do not think the grubs are so destructive on the slow-growing as the fast-growing potatoes. About thirty years ago when working at home with my father, he had 5 acres of Early Rose completely destroyed by potato grub, or fly as the farmers usually call it. I do not think that this pest is on the increase, as we are only troubled with it in hot, dry years. In wet seasons, or as long as the ground is moist, we see nothing of the grub, but once let the ground become hot and dry and the grub will soon be noticed moving about; and, if it once finds the least opening, it is down into the potato quick and lively. As to the percentage of damage done by these grubs it would be hard to estimate. For my own part, generally as soon as I see the grub making its appearance I put on plenty of hands and rush the potatoes out; that is the only sure way, or it may spoil the lot. A very good preventive is to till the potatoes a second time, so as to fill up all the cracks in the soil. I have tried it myself a time or two when men were scarce, and it proved very successful; but there is nothing better than the rain for checking the pest. In keeping my seed potatoes in summer time, when stowed in the shed covered with grass, I find an occasional watering keeps them quite free from the grub, when without it they are very often riddled. Of course, I mean in hot, dry summers when the grubs are plentiful."

Mr. C. R. Garnham, Dunmore, Largs, writes:—"I have no potatoes at present infested with fly, mine being, fortunately, free; but a friend has promised to send me a couple of specimens, and upon their receipt I will forward them to you. As to the length of time the pest has been known here, I can only say that I have been farming in this district all my life, a period of over forty years, and I cannot remember a time when they were not a pest—the worst potato pest we have. They are bad every season if the weather happens to be dry about the time the crop is ready to harvest. If the season is wet they do no damage. Rain seems to be their relentless foe. If a crop has been attacked (even badly), and a fall of rain occurs (sufficient to close up the cracks), their depredations at once cease. When potatoes are put by for seed, we find it very difficult to keep the fly out of them; and the remarkable thing is that they always attack the crown first. I find it a very good thing to sprinkle the seed occasionally with water. It is very difficult to say what percentage is destroyed by this pest. If the crop is not harvested immediately their presence is detected (when the weather continues dry) they will destroy the whole crop, and it may be noted that when once they start they make rapid progress."

Mr. A. Hannabus, Windsor, writes:—"Some fortnight after I had dug my potatoes, and burnt off all the tops and ploughed the land, I harrowed it, and, to my surprise, the moths flew up from it as plentiful as ever, and, mind you, the ground was thoroughly clean and free from rubbish of any kind."

## BIBLIOGRAPHY DEALING WITH THE POTATO-MOTH.

**Boisduval, Dr.**

J. B. Soc. Centr., Hort., Nov., 1874.
The original description of the potato-moth given in this paper. From one specimen bred from Algeria. I have not been able to consult this paper.

**Berthon, Captain H.**

On the Potato Grub of Tasmania.
Proceedings of the Royal Society of Van Dieman's Land, Vol. XXX, 1855, p. 76.
This is the first record of the potato-moth.

**French, C.**

The Potato-moth (*Lita solanella*).
Handbook of the Destructive Insects of Victoria. Part II, chap. 38, p. 147, plate 33, 189.
Observations upon the pest by growers, and general account of pest.

**Kirk, T. W.**

Leaflets for Farmers, No. 16, Department of Agriculture, New Zealand, 1894 (with wood cut).
Potato-moth, Potato Tuber-moth, Potato Grub (*Lita solanella*).
A general account of the damage done by the moth in New Zealand.

**Meyrick, E.**

On a Micro-Lepidopterous Insect destructive to the potato.
Proceedings of the Linnean Society, N.S.W. Vol. IV, p. 112, 1880. Identifies the moth as Boisduval's species, and records it as a well known pest in the Hunter River district.

**Ragonot, M. E. L.**

Communicating a note upon a Tinea attacking potatoes.
Bulletin Société Entomologique de France, pp. XXXV–VII, 10th Fevrier, 1875.
Records Boisduval's species as a good one, and other notes on allied species.

**Riley & Howard.**

The Potato Tuber-moth (*Lita solanella*).
Insect Life. Vol. IV, p. 239, 1891 (wood cut).
The first record of the pest in America.
Report of Entomologist, Dep. Agriculture, U.S.A., 1892. Notes on *Lita Solanella*.
Insect Life. Vol. VI, p. 275, 1894.
Editor's note on paragraph in the *Californian Orchard and Farm*, Sept., 1893, in which it was stated that potato-moth was known in California as far back as 1856.

**Olliff, A. S.**

Entomological Notes. The Potato-moth (*Lita solanella*, Bond) destroying tobacco at Tamworth.
*Agricultural Gazette*, N.S.W. Vol. III, p. 701, 1892.
First record of this moth as a tobacco-leaf pest.
Suggestions for observations and experiments to lead to a more complete understanding of the life history of the potato-moth and its ravages.
Entomological Notes, *Agricultural Gazette*, N.S.W. Vol. III, p. 828, 1892.

**Tepper, J. G. O.**

The Destructive Potato-moth.
Transactions of the Royal Society of South Australia. Vol. IV., p. 57, 1882.
A general account of the life history, and suggestions for remedies.

**Tryon, H.**

The Potato-grub (*Lita solanella*, Boisd.)
Report on Insect and Fungous Pests, Queensland. Chapter VIII, p. 175, 1889.
A report upon the ravages of this pest in Southern Queensland, and life history.

## FUMIGATING HEDGES FOR SCALE AND OTHER INSECTS.

It is not uncommon to see fine hedges, valuable not only from the point of ornament, but as wind-breaks to gardens and plantations, being destroyed by scales or other insect pests. Spraying is quite out of the question in the case of a densely-grown hedge, and even where the mixture can be easily applied to all parts of the growth, the results are not always very satisfactory.

In August last it was reported that a fine pittosporum hedge at the Nowra Manse was infected with scale. The Entomologist found this scale to be of the genus *Antecerococcus*, a pest common to native shrubs.

In order to test the practicability of fumigation for the destruction of this scale, Mr. Froggatt visited Nowra, and treated the hedge, tying it up in sections of about 9 feet.

While in the Nowra district last month, Mr. Froggatt inspected the hedge, and found that the scale had been absolutely destroyed.

# Wheats at the Bathurst Farm, Season 1902.

R. W. PEACOCK.

THE conditions under which the various wheats were grown were decidedly droughty, the rainfall being 14·83 inches for the year, or about 10 inches below the average. The following are the falls:—

| | | | |
|---|---|---|---|
| January ... | ·74 | July ... | 2·25 |
| February ... | ·37 | August... | 1·16 |
| March ... | 1·21 | September ... | 2·18 |
| April ... | ·00 | October ... | 1·00 |
| May ... | ·13 | November ... | 1·59 |
| June ... | ·50 | December ... | 3·70 |
| | | Total......... | 14·83 |

It will thus be seen that the light rainfall was not distributed to the best advantage. The light falls of April, May, and June were not sufficient to ensure the regular germination of the seed, resulting in many instances in patchy crops. The heavy falls of December came too late to benefit the wheats, some being harvested before they fell. In all 75 acres were sown, the yields ranging from 3½ bushels to as high as 23 bushels per acre; the average for the whole area being 8⅓.

Owing to various causes, such as differences in treatment and soils, all the varieties cannot be compared with each other. I will endeavour to place together only those which allow of faithful comparison.

The following are the varieties and their yields, as grown in areas comprising several acres each:—

| | Variety. | | Yield. |
|---|---|---|---|
| Comparable | Steinwedel | | 20 bush. 50 lb. per acre. |
| | Bobs | | 19 ,, 23 ,, ,, |
| | Nonpareil | | 17 ,, 49 ,, ,, |
| | Lambrigg White Lammas, Portion I | | 17 ,, 13 ,, ,, |
| Comparable | Blount's Lambrigg | | 5 ,, 28 ,, ,, |
| | Lambrigg White Lammas, Portion II | | 4 ,, 36 ,, ,, |
| | Power's Fife | Manitobas | 4 ,, 32 ,, ,, |
| | Minnesota Blue Stem | | 4 ,, 16 ,, ,, |
| | Scotch Fife | | 4 ,, 13 ,, ,, |
| | Algerian, Part I | | 19 ,, 12 ,, ,, |
| | Algerian, Part II | | 15 ,, 8 ,, ,, |
| | Hudson's Early Purple Straw... | | 9 ,, 34 ,, ,, |

The first four are comparable, and were grown upon land which was broken up during the preceding spring, and remained until midsummer, when it was again ploughed, and produced a crop of maize for green fodder. The land was in excellent condition, and had retained an appreciable amount of moisture from the preceding year.

The following five were grown upon similar land to the former, broken up at the same time, the essential differences being that it was sown immediately with maize early in the spring, had not the extra ploughing at mid-summer, and lacked the moisture and condition of the former.

The difference in the resultant crops was most marked as is shown in the yields of Lambrigg White Lammas. A yield of over 17 bushels was obtained from portion No. 1, whilst only 4 bushels 36 lb. was obtained from portion No. 2. This wheat was grown in one block, and as the difference was so striking, care was taken to have it estimated. The heavier yield was due largely to the moisture carried over from the previous year by the extra ploughing, and the smaller drain upon it by the lighter autumn maize crop. The better condition of the soil allowed of the more even germination of the seed at a time when it was extremely difficult to get the crops above ground.

The next five also are comparable with each other, and represent the slower maturing wheats. Three are the strong-flour Manitoba wheats. They proved unable to withstand the conditions of the season.

The Algerian wheat belongs to the class suitable for the manufacture of macaroni. It was grown upon land, portion of which had received different treatment. Plot I had received extra cultivation during the preceding autumn, and yielded an excess of 4 bushels per acre. One of the features of this wheat was its apparent resistance to drought, it not showing any signs of distress whatever throughout its growth.

Hudson's Early Purple Straw was used in conjunction with a manure experiment, and, therefore, is not comparable with any of the others. It yielded from 3 bushels 30 lb. to 23 bushels 20 lb. per acre, with an average for the 10 acres of 9 bushels 34 lb. This yield was obtained from land which had been bare-fallowed throughout the previous year.

Throughout the season the advantages of good cultivation were strikingly apparent, and such methods as bare-fallowing, ploughing the stubble land as soon as possible after the preceding harvest, the better preparation of the seed bed, the use of the seed-drill, the choice of suitable varieties, and the sowing of less seed than is ordinarily sown per acre, can be strongly recommended to farmers desirous of obtaining the best results under similar conditions to those which obtained at this farm during the past season.

IRRIGATED agriculture, as representing the leading industry in the future of a vast portion of the country, and in particular of the arid region, is rapidly forcing to the front the question of irrigation as one of the great national issues of the day, since without water there can be no agriculture, and in like manner the need for irrigation is equally forcing to the front the question of forest preservation, since without forests there can be no water. Forests are an essential factor in any scheme of irrigation of sufficient magnitude to contemplate the reclamation of our millions of irrigable lands which are now arid.—*Texas Stockman*.

# Co-operative Agricultural Associations.

SOME years ago there was a movement in England in the direction of the formation of co-operative Agricultural Associations. One of the first Associations formed was at Muskham, a small village in Nottingham, in May, 1899. The membership fee—or, more properly speaking, share—was fixed at 5s., with 1s. 3d. called up. For the first few months the Association had only seven members and the secretary—the bare number required for purposes of registration. By degrees other members came in until, according to the Journal of the Board of Agriculture, there were last year forty-seven members, including men farming 600 acres as well as those cultivating 2 or 3 acres, with a sprinkling of farm-hands who keep a pig or two.

One of the main objects of this co-operative Association was to purchase in bulk goods and appliances required for use by members on their farms.

The first important transaction was the purchase of a reaper and binder. The price was £32. To raise the money a form of guarantee was drawn up, whereby each and all of the seven members who at that time comprised the Association became security in the sum required for the purchase. The following regulations were adopted in connection with the working of the machine on the holdings of the members:—

That one of the members be placed in charge of the machine with remuneration at the rate of 6d. per acre cut.

The charge to members for the use of the machine to be 4s. 6d. per acre, time included.

The secretary to have the arranging of how and where the machine was to be worked.

Each user of the machine to convey it from the farm where last in use.

The last user of the machine to take it back to the place where it was to be stored until next season.

It may be stated that the rate fixed by the Association for the use of the machine worked out at 6d. per acre less than the ordinary charge in the district. At the end of the third season the reaper and binder was in excellent condition and the Association were in a position to reduce the fee to 4s. 3d. per acre.

The Association approached the railway company with the object of securing better facilities for the despatch and transport of produce. In the early days of the Association it was found that merely to collect requirements and order in bulk did not produce the fullest advantage to the smaller farmer members. A store was taken in the village, and it is now possible for a labourer member to purchase a few pecks of maize or feeding stuff for his poultry or pigs at the same rate as the large farmers.

Special efforts have been made by the Association to provide educational facilities for the district. In 1900, it made arrangements with the Technical Education Committee of the Nottingham County Council for the delivery of lectures on agricultural subjects. In the following spring, arrangements were also made for carrying out experiments to demonstrate the value of various manures on straw and root crops. In the summer of 1901, an excursion was arranged by the Society, when over twenty members visited the County Council farm for the purpose of obtaining information as to the methods of up-to-date cultivation practised there.

Mr. J. Nugent Harris gives the following particulars of the financial transactions of the Muskham Association during 1902 :—Purchase of feeding stuffs, £257 ; coals, £140 ; machinery, £121 ; amount paid in freight to the railways, £37 ; credit balance in hand, £5. The item, "amount paid in freight to the railway company" is of considerable interest, as it shows how important a revenue even small agricultural co-operative societies can yield to the railways with a minimum of trouble. The railway company, instead of having to deal with thirty or forty individuals, has only to do with the Society, and is thus saved much trouble and expense. This applies equally to the merchant who supplies agricultural requirements. The Society saves him the bother and risk attached to the keeping of a large number of accounts and the collecting of the moneys represented by such. It is, therefore, natural that the Society should expect from the railway company the lowest possible freights, and from the merchant or manufacturer the best possible terms.

In other parts of England other co-operative Associations on the lines of the Muskham Association have been formed with excellent results. At Far Forest, in Worcestershire, a Society established on the "purchase and sale on joint account" principle, has proved a great success. It was no easy task to induce farmers and small holders to abandon the customs of centuries and buy and sell in common. Yet within twelve months the majority of the Far Forest farmers were members of the Society. One important move was to arrange for the purchase of feeding stuffs of pure quality in sealed bags. The members soon learned to appreciate a pure article, and would have been attracted by the quality even had not the price been reduced. In poultry, fruit, eggs, and other minor lines of farm produce, the Society is a vendor. Its purchases include manures, wire-netting, and all farmers' requisites. It also owns a manure drill, which is available to members at a small fee.

There are many districts in New South Wales where farmers could co-operate very advantageously to procure such implements as seed and manure drills, which are capable of effecting great saving in seed and fertilisers, and get over the work so quickly that within a brief sowing period many hundreds of acres could be covered.

Another co-operative Association has been formed for the purpose of sterilising milk and cream and for the sale of butter. This

Association, known as "Vicar's Farm," is also doing good work in the improvement of the poultry of the district. By the distribution of sittings of eggs they have succeeded in introducing into the poultry yards of the district improved fowls, and have induced people to take pride in their flocks. This feeling spreads far beyond the membership of the Society, and in the district in question the poultry industry has received a remarkable stimulus. This may not directly benefit the co-operative Society, but it is the fulfilment of its mission. Another important work carried out by a co-operative Association was in connection with the improvement of water supply for the Vicar's Farm district. In some cases people had to carry water, even for ordinary household purposes, over a mile, and for drinking purposes still further. The cattle had to be driven long distances to water. The task of providing a supply even for one household was beyond the means of any individual farmer, but in co-operation the farmers were enabled to make adequate and convenient provision for the residents of the district at a cost bearing lightly on each.

Another co-operative Society at Bewdley has developed into a successful distributing and marketing agency for market garden produce and fruits like cherries. The questions of grading, of suitable packages, and of disposal of the lower grades of fruit by pulping or otherwise are studied, and it is felt that before long the Association will be in a position to handle the whole of the produce from members' holdings and find profitable outlets for many lines that are now disposed of at a direct loss or tend to reduce the price of the better grades of produce. This society has also established a co-operative sheep-dipping station. A large "swim-bath," a drying floor, suitable pens, &c., are provided. Any member giving one day's notice can drive his sheep there and dip them. The charge is 1d. a head, which returns the Society a good profit and is a saving to the farmer. Moreover, the provision for effective cleansing of the sheep is far better as arranged on this large scale than anything a farmer of small means could provide for himself, and is thus more satisfactory all round.

Co-operation in agricultural matters is a growing force. The feeling in favour of combination is gaining ground, and instead of looking for imaginary remedies all are beginning to understand that the remedy largely lies in combined action for the common good.

In Europe, co-operative Agricultural Associations have for over twenty years been important factors in the advancement of the interests of farming communities. In the Netherlands the co-operative Associations of onion, cauliflower, and gherkin growers have, by dint of excellent organisation, opened the doors of the English markets to their members. So keen has the competition by the Dutch co-operative selling Associations become that the growers in several parts of England who formerly supplied the trade have been completely ousted, and it is quite possible that they will never regain their market foothold until they become as well organised as their Dutch rivals. As an instance of the extent to which agricultural co-operation can be successfully carried, the following particulars of the union of agricultural co-operative Societies is of interest.

The first agricultural co-operative institutions were started in Bavaria in 1877. In 1881 there were forty-two such Societies in the country. In 1901 there were 2,600, with 171,000 members. In the early nineties the inconvenience of the want of a central organisation for the multiplying Societies began to be felt, some belonging to one or the other of the two leading organisations, and others standing alone or in smaller independent unions. The Bavarian Government, about thirteen years ago, decided that the movement was one deserving of State help. At the end of 1893, a Bavarian Union of Agricultural Loan Bank Societies was formed, affiliated to the general (Darmstadt) union, and at the same time the Bavarian Central Loan Bank was started with financial aid from the State. This took the shape of a free grant of £5,000, and a deposit of £5,000 in scrip. In 1898 a further free grant of £5,000, and an advance at 3 per cent. of £95,000, were made, and in 1900 an additional sum of £100,000 at 3 per cent. was advanced. Certain advantages as regards interest on secured overdrafts on the Royal Bank were also granted to the central co-operative bank to help it through its first year. These privileges ceased on 1st January, 1902, when the bank was expected to be in a position to hold its own without further special favours. In 1894 48 societies were affiliated to the central bank. In 1901 there were 1,645 affiliated societies, the value of whose collective credit was estimated at £147,250.

A branch of the Central Bank (Raiffeisen) was established at Nuremburg, in 1895, independent of the Bavarian Semi-State Bank, and in 1898 counted 314 affiliated societies doing business to the extent of £489,843 turn-over. There are also minor institutions of a similar character. Besides these institutions for the organisation of personal credit, an important step in the organisation of real credit was taken in 1896 by the establishment of a mortgage debenture association on co-operative principles, having in circulation last year mortgage debentures to the amount of £1,366,635.

It will be noted that the most important operations of agricultural co-operation in Bavaria are concerned with the organisation of agricultural credit, but agricultural co-operative societies are also doing business in the wholesale purchase of seeds, manures, feeding stuffs, and machinery and implements, to the extent of £503,493 and in the co-operative sale of produce to the amount of £313,905 (in 1902). There are 150 dairy societies and sundry special co-operative societies for the sale of fruit, hops, wine, tobacco, and other products; also 11 important and 976 minor co-operative cattle-breeding (bull) associations, 86 pig-breeding associations, and 140 boar-keeping associations, besides sundry associations on co-operative principles for drainage and irrigation, for steam threshing, and for mutual insurance of all kinds, including cattle insurance.

In France the co-operative movement has spread throughout the whole of the farming population, and there are all sorts of organisations for the purchase of agricultural requirements, for the disposal of produce, and for providing monetary assistance at low rates of interest.

In addressing a large gathering of United States farmers, Mr. Myrick, editor of the *American Agriculturist,* thus summarised the form of agricultural co-operation which is regarded in America as the most effective and successful.

Practically all the producers of any given crop become shareholders in a corporation that has charge of the distribution of the crop. The product is graded according to the rules of the corporation, and is shipped to various markets in such manner as to preserve a healthy demand in all markets, avoiding an accumulation of surplus with consequent price cutting. Competition is thus avoided of producers in one section with another and fair prices are returned to all producers. On the other hand the wholesale and retail dealing in the various markets is simplified and reformed, and the expense of distribution so reduced that consumers are greatly benefited by receiving the best quality at reasonable prices.

This reform in distribution and marketing has met with assured success. It is no longer an experiment. It is certain to come into more and more general use. This reform is vital to the financial welfare of producers of any specialty. Manufacturers, railroads and other interests are rapidly realising the benefits of combination. Producers must co-operate along similar lines in self-defence, as well as to insure increased profits.

Nor is the problem a difficult one in the case of certain specialties. There is no excuse for the disastrous competition that is now so frequently witnessed between the producers in different sections of such crops as cranberries, onions, asparagus, peppermint, cauliflower, potatoes, tobacco, hops, wool, apples, cheese, and butter, eggs, poultry, and many other agricultural specialties.

Business ability among farmers in general and producers of specialties in particular, is commoner than is generally recognised. This has been demonstrated again and again in the successful management of various business enterprises by farmers. The best of them readily develop business ability when placed in a position that gives them experience, while the judgment of such men in matters pertaining to business and finance is often singularly sound.

It will no longer do for producers to say they cannot co-operate. They can, will, and must. But this work is to be done through properly incorporated corporations, started and maintained on strictly business principles.

Mr. Myrick's remarks apply with equal force to the conditions of the farmers and fruit growers of New South Wales, and it is to be hoped that before long there will be established, on co-operative lines, depôts and factories to control the distribution and utilisation to the best advantage of the huge quantities of produce, especially fruit, that at present return little or nothing to the grower.

# Cicadas ("Locusts") and their Habits.

By WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

The most familiar sound that heralds the Australian summer is the remarkable screech of the Cicada. There is no escaping it, even in the heart of the city, for wherever an old tree still rears its head in spite of bricks and mortar, the sharp note is to be heard. In the parks, gardens, and bush the air veritably pulsates with the volume of sound. The only thing that stops the noise between sunrise and sunset is a sudden rain or wind storm, while on a hot, windless night the cicadas will sometimes sing right on, but in a more subdued tone.

The musical powers of the cicadas have attracted attention to the insects from a very early date, and several species were well known to the ancients.

The cicada was famed in song and story by many Greek writers, who in their way knew a great deal of general natural history; but either our ideas of musical sounds have changed, or one of the Grecian cicadas had a more melodious note, for a cicada sitting upon a harp was the usual emblem of the science of music. Though they knew that it was only the males that called, they thought that they fed upon dew; and some writers named them the Nightingales of the Nymphs. In other ways they were admired, for we find their images struck upon coins, and the Athenians were accustomed to fasten golden ornaments of cicadas in their hair, calling them "sons of the earth," in reference to their underground habits in the early stages of their existence.

The writer Anacreon, addressing the insect, says: "The Muses love thee; Phœbus himself loves thee, and has given thee a shrill song; old age does not wear thee; thou art wise, earth-born, musical, impassive, without blood; thou art almost like a god."

Yet, though the Greeks almost worshipped them, they did not refrain from eating both the pupæ and females before they had laid their eggs. Some of the American entomologists have since followed suit, but they record that the experiment was not a gastronomical success as far as soups and stews were concerned, but when fried in butter the pupæ were very palatable, and not unlike shrimps.

We have records older than those of the Greeks of the cicadas, for they are frequently found represented on the Egyptian monuments, where they are said to be emblems of the minister of religion.

These insects, in other parts of the world, are credited with quite as an unpleasant note as our species, and one of the commonest in Italy makes a most deafening call. A South American species is said to have such a shrill call that it can be heard a mile away; another has been likened to the screech of a steam-whistle; and according to Riley, the famous American "17-year old locust" has a series of most discordant notes.

It is somewhat remarkable that the most accurate description of the musical apparatus of the cicada (so different from that of all other sound-producing insects) should have been published by the French naturalist, Reaumer, in 1740, and all the descriptions given in popular works and text-books are taken from his work.

The male has a large plate on either side of the under surface of the body attached to the corselet, but extending over the basal portion of the abdomen, beneath which is a cavity formed into two cells, occupied by two small, thin, glass-like plates, which Reaumer called mirrors; above these are bundles of muscles, which lead to two membranes formed like kettle-drums, each of which has a convex and concave part, the first of which is folded and full of ridges.

Haswell describes it thus: "The loud shrill note emitted by the insect is the result of a quick succession of crackling sounds produced by the movement of the stiff membrane with its horny ribs, through the agency of the muscle. Under ordinary circumstances, the sounds follow one another with sufficient quickness to produce a continuous note, and this is effected not by the contraction of the muscle as a whole, but by the successive contraction of individual *fasciculi* (different filaments forming the whole), all of which act on the horny plate, and thus the movements of the muscle on the tendon during the production of the note resemble those of the hammer-board of a piano when a number of keys are being struck in quick succession." An American entomologist defines it more briefly: "If one took a thin tin dish and bent the convex bottom backwards and forwards rapidly, it would represent the kettle-drum membrane and produce the same kind of sound."

Cicadas are in no way related to locusts or grasshoppers, but belong to a different order of insects with very different habits, for the true plague locust of ancient and modern times is a grasshopper with short antennæ, biting or chewing mouth, and abdominal plates adapted for boring into the ground, while the cicada has a long tubular mouth, only adapted for sucking up sap. This misnomer is not, however, confined to Australians, for cicadas are popularly called "locusts" in other parts of the world, and the error originated in the translation of the word, which was applied to both. In Italy the cicada is called cicala; in France, cigala, which means both locust or grasshopper; in Spain it is named cigarra. The exact derivation of the word is doubtful, but most writers give *ciccum*, a thin skin, as the root. Linneaus first used the word cicada to define the genus *Cicada* in 1748 as the typical group of the family, which now comprises a number of distinct genera. These insects are the giants of the Order *Homoptera*, and are chiefly confined to the warmer latitudes, being widely distributed over the south of Europe, Africa, America, South and Central Asia, Australasia, and the islands; one small species (*Cicadetta montana*) is found in England, but it is a comparatively rare insect. They have been found in a fossil state in the miocene rocks of Europe; others have been described from specimens entombed in fossil amber, and Etheridge has described and figured a fossil species obtained at Talbrager River under the name of *Cicada Lowei.*

From all parts of the world some 800 species have been described, and the Australian region is particularly rich in large handsome forms, while the neighbourhood of Sydney seems to be the head-quarters of a number of our largest and noisiest species. One of the best known foreign species is the American 17-year-old cicada (*C. septendecim*), which, crawling down on to the roots of the trees in the larval state, remains hidden deep underground for a period of seventeen years before it has undergone its transformations and is ready to emerge. This cicada was noted as far back as 1715 in Philadelphia, since which time a record has been kept, and the exact time of the reappearance of each brood can be foretold within a month. They appear in millions, and sometimes do a considerable amount of damage in the forests by cutting the branches when egg-laying. This is the species that forms the curious cicada cities when for some unknown reason they reach the surface of the ground before they are quite ready to emerge, and construct rounded domes of clay over their vertical shafts in the ground, sometimes up to 6 inches in height. Sometimes acres of land are so thickly covered with these little turrets that they almost touch, and, where the forest fires have previously burnt over the ground, are very conspicuous.

All our larger species seem to confine their attention to old or well established trees; all the pupæ opening out their shafts within the radius of their roots, and rarely appear near young or newly-planted trees; but the smaller species are just as plentiful on grass land, and must attack small shrubs. The cycle of life of no Australian species has been worked out, but I think it will be found that the subterranean life of several of our large cicadas is about three years, while some of the smaller forms do not take more than a single season.

Though cicadas appear at intervals in immense numbers, and each female is capable of depositing up to 300 eggs, yet they have a great many enemies, and will, most probably, vanish in the course of time in the settled districts. In a recent visit to Melbourne, I noticed that they were not half as much in evidence in the suburban gardens as they are about Sydney, and as the introduced sparrows, minahs, starlings, and blackbirds are so numerous as to be serious pests in the Southern capital, they can probably account for the difference. It is well known in America that the "Digger wasps" store their nests with cicadas; but though I had long suspected, I could never get actual proof that our large sand wasp (*Priocnemis* sp.) had the same habit, and it was not until this season that I proved this to be the case. Through the kindness of Mr. Walter Armytage, who observed these wasps excavating their burrows in his garden at Mosman Bay, I was enabled to obtain a fine series of the wasps, cicadas (of half a dozen species) with the eggs and larvæ of the wasps attached to the cicada.

My assistant, Mr. Gurney, dug out a number of these wasp burrows varying in depth from 10 inches to 2 feet. In one of these five cicadas were obtained, two of which had the wasp egg attached to the under surface of the thorax between the legs; and though the eggs hatched, they only lived for a few days feeding upon the moribund cicada. The wasps do not kill the cicada, but after stinging it run along over the sand straddled over it, holding the body with the long hind legs, and using the two front pair for progression. The majority of the cicadas taken out of the wasp nests showed signs of life, and would move their legs when touched; but some were too severely stung and had died. Another wasp (*Priocnemis bicolor*) chases the black cicadas off the trunk of the white gums, and if they do not move quickly enough, drags them off, but does not attempt to sting them; the wasp calmly takes possession of the cicada's seat, and drinks the sap that is exuding from the puncture made by the pointed beak of the cicada.

The earlier settlers could hardly help noticing the "locusts" about the shores of Sydney Cove, and specimens of the larger showy species soon found their way to the museums of the old world, for we find Donovan describing one in his "Insects of New Holland, 1805," and Dr. Leach two more in 1817. Most of the earlier writers in Australia had something to say about "locusts," but the descriptions of our different species are scattered through a number of foreign Journals and Transactions of Societies, which are difficult to obtain in Australia, and others are described by Walker in the British Museum Catalogues.

In the following notes, I propose to give a brief account of some of the most prominent Australian species, so that they can be easily identified.

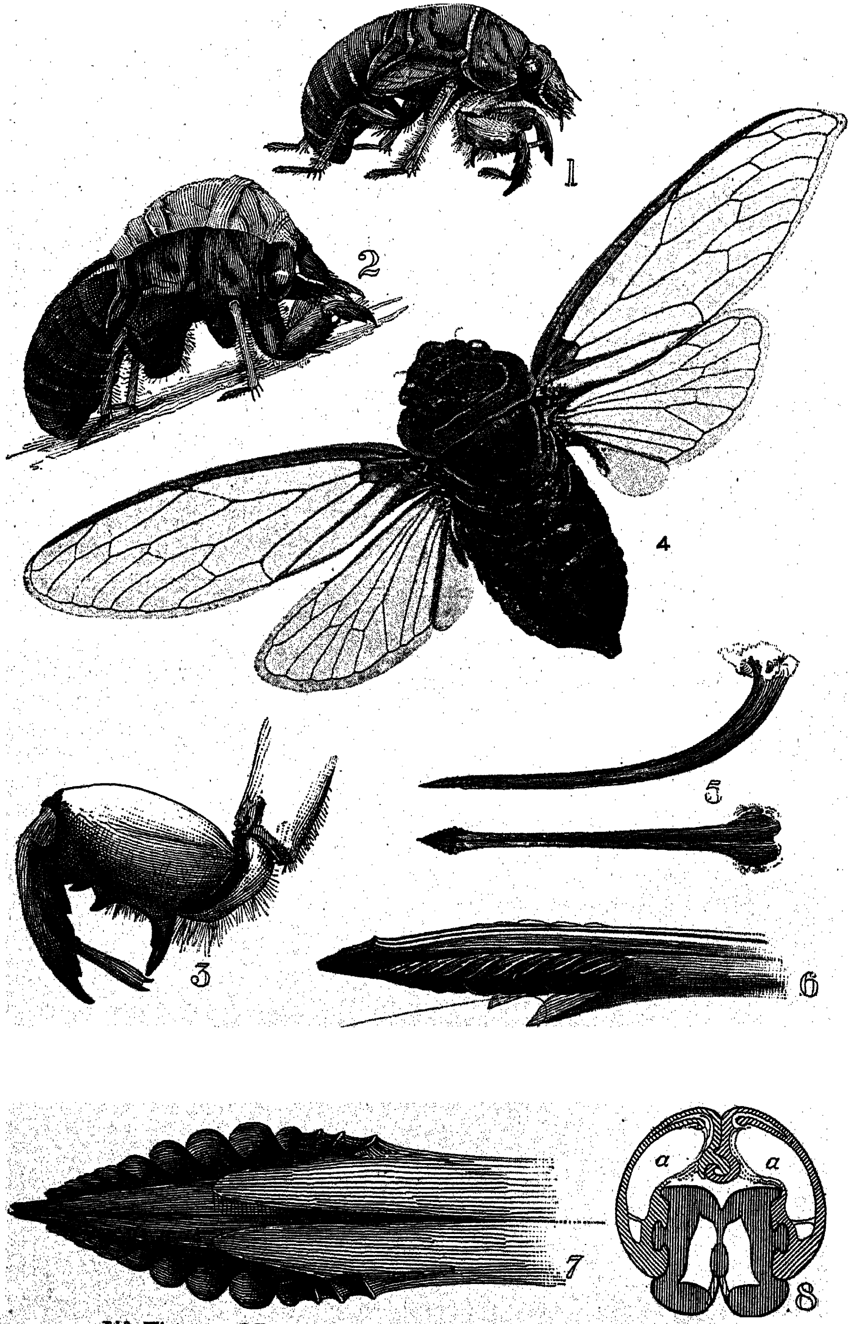
### *The Green Monday* (Cyclochila Australasiæ, *Amyot.*)

This cicada is very variable in its colouration, and the green and yellow forms are popularly called "Green Mondays" and "Yellow Mondays"; but others have a dark key-like mark on the pro-thorax, an A-like mark on the back; some have the abdomen black. It measures up to 5 inches across the outspread wings, and not quite 2 inches from the front of the head to the tip of the body. General colour, rich green, except the basal portion of the nervures of the wings close to the body, which are reddish-yellow, with the remainder semi-transparent; but after death the green shades may vary into all shades of yellow and brown. In the yellow variety there is no trace of green, that colour being replaced with brownish yellow.

This species was first described by Amyot and Serveille in their "Natural History of Insects"; next described and figured by Donovan in his "Insects of New Holland," in 1805; then under the name of *Cicada Australis* by Leach in 1817; and Germer again redescribed it under the name of *Cicada olivacea* in 1834.

Professor McCoy gives a fine coloured figure of this species in his "Podromus of the Zoology of Victoria," but says it is not as common there as the black cicada.

About the last week in October this species first commences to emerge from the ground, and is singing in full force early in November;



**Life History and Details of the Green Monday,** *Cyclochila Australasiae.*
1. Pupa on emergence from the ground. 2. Pupa when splitting the skin for perfect insect to emerge. 3. Fore leg of pupa. 4. Perfect insect. 5. Ovipositor and sheath separated. 6. Side view of ovipositor. 7. Ovipositor viewed from above. 8. Cross section of ovipositor, showing cutting saws and egg passages.

and, though they remain in evidence until the latter part of January, their place is taken to a great extent by other species. Their favourite localities are the suburban gardens, where in the larval state they feed upon the roots of nearly all our large trees. I counted forty climbing up the trunk of an English oak, growing in my garden, at daylight on the 15th of December.

The pupæ emerge from their vertical shafts about 8 o'clock in the evening, though they may have opened them out early in the day; but though it is common to see them with the point of the head level with the shaft, it is very exceptional to find one away from it in the daytime. They climb up the first fence or tree trunk they come across, on an average about 4 or 5 feet, and then anchor themselves by their sharp claws; with a few contractions the pupal skin splits down the centre of the back, and the nymph emerges head first, and has generally cleared the shell about 9 p.m., a most comical frog-like creature with the wings rolled up like a rounded pad on each side, and the green tint very bright and delicate. The wings now begin to unfold, and by half-past 10 p.m. they are fully developed and folded down the sides, so that the cicada has the whole night in which to harden and dry its outer covering and wings before daylight, when it can fly and escape from its many enemies. As a general rule any pupæ captured and confined that do not emerge from the shell the same night die, but sometimes they will remain alive for a couple of days and then come out perfect insects.

When calling, the male droops his wings down the sides of his body and elevates the tip of the abdomen, and, for his size, can make more noise than any other insect.

The cycle of the life-history of this cicada is unknown, but, from the exceptionally large numbers that appear about Sydney every third year, it is probable that it will be found to occupy about that time. The female is provided with a remarkable serrate ovipositor, which is used for cutting slits in the bark of the branchlets and guiding the long cylindrical eggs into place, where they are deposited in rows just beneath the surface of the bark. Most cicadas are said to lay about 300 eggs, but a very large proportion must be destroyed before the baby cicada emerges, and the mortality among the little creatures, not bigger than fleas, before they can make their way underground must also be very large. The baby cicada, as soon as it comes out of the egg, does not waste time crawling down the tree, but casts itself off the branch, falling to the ground, when it immediately seeks for the trunk of a tree and works its way down under the soil, following the root along in the course of its life cycle until it sometimes gets many feet beneath the surface; but in returning to the upper world, it forms a vertical shaft from beneath.

The perfect insects do not appear to feed. I have watched a great number on the trees, but never found one with its beak stuck in the bark. It is stated that the American seventeen-year-old cicada never feeds, so it is probable that it is characteristic of some cicadas, though others feed regularly.

### *The Black Cicada or Red Eye* (Psaltoda mœrens, *Germer*).

The black cicada is seldom or never found about gardens, but prefers smooth white trunks of apple gum (*Angophora lanceolata*), where they cluster sometimes in dozens, and, unlike the Green Monday, can be observed sucking up the sap through the bark with their beaks buried up to the head, and gorging to that extent that they are continually discharging a fine spray of liquid from the anal segment, which falls like a fine shower on to the ground beneath. This species was described by Germer in 1834; the pupal and perfect form, with details, are figured in M'Coy's "Podromus of the Zoology of Victoria," and Bennett noted it in his "Wanderings of a Naturalist."

It measures up to 4¼ inches across the outspread wings and slightly over 1½ inches from the front of the head to the tip of the abdomen; general colour black, with eyes dark-brown, and the ocelli red, the upper surface lightly clotted with short silvery white hairs, and a buff patch on either side of the scutellum. Wings semi-transparent, with the nervures of the forewings black and those of the hind pair ochreous, black at tips, both pair slightly clouded with ochreous at base, a slender black band crossing five cells of the forewings, and the outer margin of the hind wings edged with black. Legs mottled, sides of face and thorax beneath thickly clothed with buff hairs, and under surface of abdomen dull yellow. In my notes on "Cicadas," published in the "Transactions of the Linnean Society" some few years ago, I called this species the "Floury Miller," but it is quite a distinct species that goes under that popular name. McCoy gave this somewhat fanciful description of its cry, "Beginning with a prolonged high toned whirr in the letter R like that of a knife-grinder, loudly prolonged at a high pitch, continued for a minute or two, breaks into a series of dimunendo 'squawks' like a frightened duck in a farm-yard, loud enough to be heard a hundred yards off."

### *The Double Drummer* (Thopa saccata, *Amyot and Serve*).

This cicada has several trivial names among the Sydney boys, and though the male is well known as the "Double Drummer" on account of the large swollen covers over the drums, it is also known as the "Union Jack" and the "Washerwoman."

This species is common about Sydney, generally frequenting large trees. Its call is very distinctive; Bennett says it cries "Awóck, awóck, awóck," uttered three times in rapid succession, like the note of a bird.

It is one of our largest species, the male measuring over 5 inches across the outspread wings, with the body very short and broad in proportion, the large swollen drum-covers standing out on either side. The head and fore portion of thorax reddish-brown mottled with black; the basal half of the thorax, lighter brown with rows of irregular black marks; the drum-covers, reddish-brown, swollen out and almost hiding the busal portion of the abdomen, which is reddish-brown marbled with black, clothed with a fine silvery pubescence. Wings semi-transparent, richly blotched with orange and black, rest of the nervures ochreous with a stripe of black along the costal nervure. This is a very distinctive species, but Distant has recently described a second species from specimens received from the Australian Museum and, presumably, from Sydney, under the name of *Thopha sessiliba*, which, he says, differs from *T. saccata* in having more strongly sessile eyes, a much paler colour, the body almost glaberous above and not pilose, as in *T. saccata*; the head, sternum, and opercula ochreous beneath, not very dark, castaneous, and the abdomen narrow and more attenuated. There is in my collection a very handsome species from Townsville, Queensland, which may be allied.

*(To be continued.)*

## A DISEASE OF LARKSPUR.

[Submitted by Mr. Henry Selkirk, Lands Department.]

THE larkspurs are mostly very hardy plants. I do not remember to have ever heard of any serious disease in connection with them. This the first case submitted to this Department. The single plant submitted seems fairly well grown. It was said to have gone off suddenly. A number of seedlings were said to have been lost in the same manner. The disease was reported as somewhat prevalent in other gardens. The sample submitted is a case of root-rot, or collar-rot, and is caused by an undeterminable species of Rhizcotinia. These fungi are not yet fully understood, and the treatment recommended is more or less empirical. Liberal dressings of lime, dug well into the soil, are what I would particularly recommend. Not less than at the rate of 1 ton to the acre. As the fungus spreads by a rather visible growth in the soil, consisting of whitish stringy-looking matter, it is often possible to estimate the infested area, and to isolate it by a deep trench. This may sometimes check the spread of the fungus. In adopting this measure it is best to allow, very liberally indeed, for the suspected area, for at the margin of growth the fungus is not easily detected in the soil. If the trench is located inside this invisible marginal growth little good will be done.—N. A. COBB.

# Dairy Notes.

M. A. O'CALLAGHAN.

## DAIRY CONFERENCE.

THE Agricultural Societies in the dairying districts of the State have been asked by the Minister for Agriculture to select delegates truly representative of the dairying industry to attend a Conference, to be held at the Lands Office building, Bridge-street, Sydney, on the 16th and 17th April, 1903. It is expected that about thirty delegates, representative of the entire State, will be present; and the main question to be considered is the proposed legislation in regard to dairying.

---

## CREAM GRADING.

THE south-eastern portion of the State has had a most productive season. Around Bombala excellent crops of oats were grown, which will serve as winter fodder for stock. By the way, it appears that the Co-operative Dairy Factory at Bombala has fallen on evil days, for the company is to be liquidated. The high prices obtainable for hay and chaff no doubt have caused many farmers to abandon dairying in favour of agriculture proper for the present. There is some excellent dairying country near Bombala, but it is mostly locked up in large estates like Bibenluke Station. From Cooma to Nimitybelle, grass is scarce; but as the traveller approaches the latter town the prospects improve, and there appears fair sheep feed. The dairy factory at Nimitybelle is a high-class structure, but the supplies seem too small to pay expenses. In some years, no doubt, the supply will be more in keeping with the building. From Nimitybelle to Bega, *via* Bemboka, there is fair grass, but it is too dry to stimulate milk, and, as a consequence, supplies of milk and cream to the Bemboka factory fell off considerably during the end of February and in March. The same may be said of the country adjacent to, and the supplies to the Bega, Candelo, Pambula, and Cobargo co-operative factories. All these factories, however, have had a very good half-year, and the returns for six months ending 31st December, 1902 are considerably in advance of those of 1901 for the same period. The West End Co-operative Creamery Company, near Bemboka, for the half-year, manufactured 117 tons of butter (approximately), value, £12,236. The cost of manufacture was 1¼d. per lb. of butter, being ¼d. per lb. less than for previous half-year.

---

THE Bega Co-operative Creamery Company (Ltd.) have also had a most prosperous half-year. The output of butter was 274 tons (approximately). The butter sales for the six months amounted to £31,744, and suppliers were paid 11·17d. per lb. net for the butter value of their cream. This factory is doing good work, but it is a pity that the method of selling butter in Sydney holds out no encouragement to the classification of cream. Bega Factory adopted the system of grading cream, but later on abandoned it, as they found they could get top Sydney price for all the butter they could make from the mixed ungraded cream. The same may be said of Candelo Co-operative and West End Co-operative factories. Still, when any movement to alter this lowering condition of affairs is proposed, we find the farmers' Sydney advisers, agents, and friends opposing the matter, because it means an undue interference with the dairying industry on the part of the government. A just interference on behalf of the farmers of the State by the Government of the State, with the existing methods which are calculated to lower the quality of the dairy produce of this State would correctly describe the proposal to grade or classify the butters produced in New South Wales. The present condition of things, viz., cut-throat competition between factories for cream and between selling agents for butter, resulting in the delivery to factories of stale cream being the rule rather than the exception, has only to continue for a little while longer, and a great proportion of our dairy produce will be inferior to that made by the Siberian peasants, who a couple of years ago had never seen a cream separator. This year we had practically no butter to export, but the years of plenty will come to us again, and then we must not be surprised if the cables tell us that our butter is only fetching the same price as Siberian. There is a ready market in England for all the first-class butter we can produce, but there is "only standing room" for middle-class or inferior butters. In a plentiful market such butters are given away "at the best price obtainable," so as to make room for the tip-top article, which after all is the basis of connection between all first-class trading houses and their customers.

## DUPLICATE BUTTER ENTRIES AT AGRICULTURAL SHOWS.

MANY agricultural societies allow factories to make two, three, or even four entries of butter in the one class. The result is, that it is not uncommon to see the one factory gain 1st, 2nd, and 3rd places, practically speaking with the one butter. The practice may help to swell the butter exhibits at a show, but it is manifestly unfair to the judges and to the other exhibitors. The judges waste considerable time trying to differentiate between two boxes of butter practically similar, and the other exhibitors, who should come second and third, are left unmentioned. This occurred at a show at which I judged last week. An exhibitor of horses or cattle cannot get first and second prizes for the same animal, or two equal firsts, yet this is what practically occurs in these butter classes. An exhibitor puts in two boxes of butter from the same cream and gets two prizes. Every factory should be restricted to one entry in butter classes, and it is to be hoped our agricultural societies will see the wisdom of this course.

Bega, Candelo, and Pambula held successful agricultural shows recently. These districts have had a very good season, and, as a result, the cattle exhibits looked well. The method adopted for placing the animals before the judges is, however, anything but satisfactory. The animals are enclosed in small high pens, and the judge has to arrive at his decision without a proper view of the animals. In cases of close competition, this system must lead to many errors, and it should not be expecting too much of these societies if they are asked to have a small cattle ring, and have all animals properly paraded before the judges. The public would then take an interest in the judging, and may be able to obtain some idea of the points of the competing animals. As things are now, all interest seems centred on the horse ring. Among dairying communities, cattle should not take an inferior position to horses. It is the cattle that enable the farmers to keep the horses, and more attention should be given to the proper exhibiting and judging of the rent payers.

A three-year-old Jersey heifer, by the Government imported bull, Thessalian, was first at Bega Show.

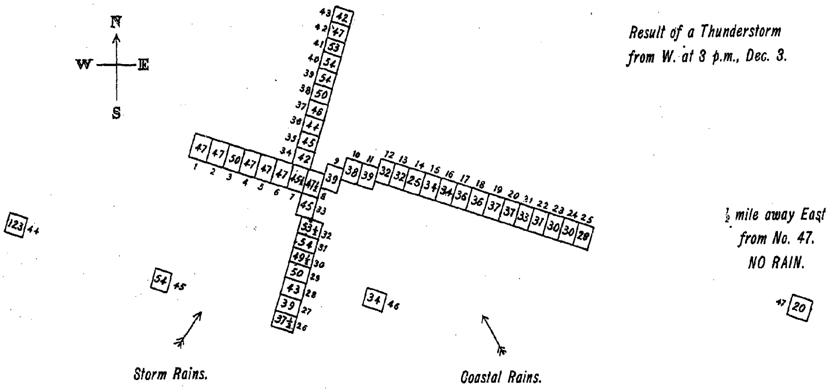
Byron Bay is one of the very few factories in the State that *grades* and *pays* for cream, according to its quality. With such a large turnover it seems probable that this company will soon market its own products instead of passing them through commission houses. With proper management the result should be an increased price for butter in Sydney. Of course the factory always gets what is known as top quotation for its first quality brand, but, as everyone knows, this is not the top price for New South Wales butter, because a halfpenny per lb. extra is freely paid for best pasteurised butter. This should also be procurable for any butter of equal quality. The question for Byron Bay directors to ask themselves is: How long are they going to continue accepting a price for their first quality which is a halfpenny per lb. under that of the real top quotation in Sydney, viz., that for pasteurised butter? Mr. Pateson, who was then manager of the Sydney Fresh Food Co. (Ltd.), did a good thing for the dairy farmer when by initiating a higher price for the pasteurised butter he broke the ice as far as paying for butter in proportion to its quality. It is to be hoped that some day in the near future *all* butter will be paid for by Sydney merchants according to the quality of the article. The present system of practically paying one price for all butter except pastry butter, is undermining the health of the dairy industry by aiding and abetting the factories in the payment of one price for creams of all ages and qualities. This means that no monetary encouragement is given for the delivery at the factories of cream in a condition which will enable the butter-maker to turn out a first-quality butter.

*H. A. College, Richmond.*

*Date*
*Recorded, Dec. 4.*

## CHART 1.

*Result of a Thunderstorm*
*from W. at 8 p.m., Dec. 3.*

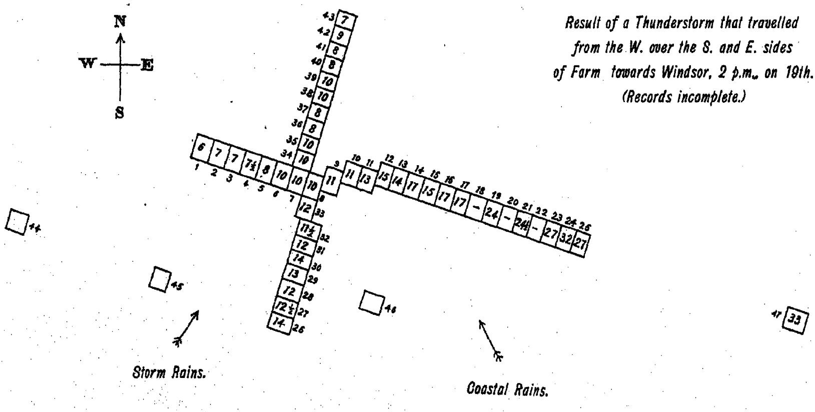


*½ mile away East*
*from No. 47.*
*NO RAIN.*

*Date*
*Recorded, Nov. 20, 1902.*

## CHART 2.

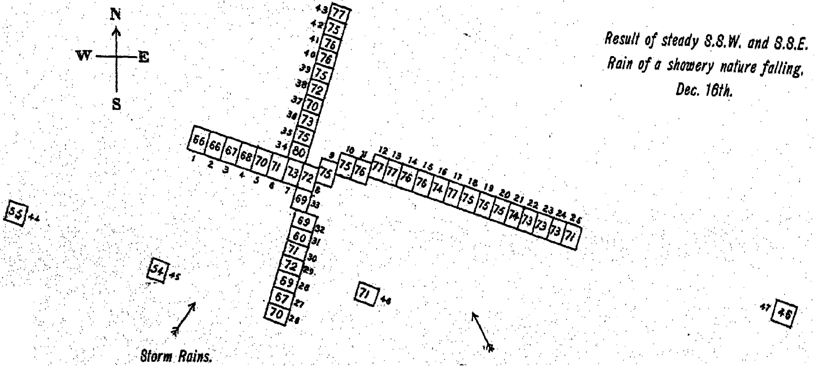
*Result of a Thunderstorm that travelled*
*from the W. over the S. and E. sides*
*of Farm towards Windsor, 2 p.m., on 19th.*
*(Records incomplete.)*

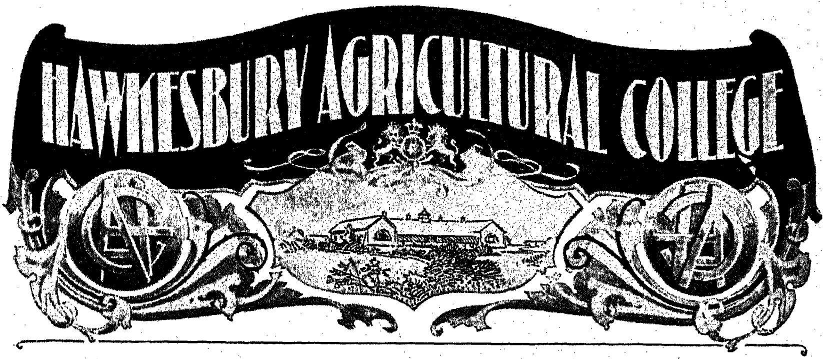


*Date*
*Recorded, Dec. 17th.*

## CHART 3.

*Result of steady S.S.W. and S.S.E.*
*Rain of a showery nature falling,*
*Dec. 16th.*





# HAWKESBURY AGRICULTURAL COLLEGE AND EXPERIMENTAL FARM.

## VARIATIONS IN RAINFALL AT H. A. COLLEGE.

C. T. MUSSON.

### Progress Report.

In accordance with instructions received, 50 rain-gauges were placed in position during early October—47 on the College Farm and 3 along a line roughly parallel with the N.W. and N. boundary, but at distances approximating 6 miles therefrom. They are set on the ground, the rim standing 14 inches above it, and fixed by means of wooden pegs driven around them.

Regular observations commenced with the fall recorded on the 20th October, 1902.

The object of this work is to show the actual amount of variation at certain points over a given area, particularly with respect to variations at short distances apart, and the effect of obstructions such as trees, buildings, &c., from an agricultural point of view—*i.e.*, as to the effect on crops, particularly experimental work.

Of the College gauges, 43 are placed in two rows, running approximately—

No. 1 line, W.N.W.—E.S.E., 25 gauges, distance apart 69 yards 2 feet, length of line about 1 mile, representing 25 separate square blocks of land each with an area of 1 acre.

No. 2 line runs S.S.W.—N.N.E., 18 gauges, same distance apart as others, length of line ¾ mile, each gauge marking centre of an acre of land as in other case. This line intersects the first at a point somewhat west of its centre, and runs at right angles to it.

Four other gauges are disposed to the south of the main line, one at the west end, another near the east end of farm, the two being 3 miles apart; another two make a line with these at somewhat regular intervals, and ½ mile south of line No. 1.

Reference to the charts will show at once the disposition of the gauges. The College building lies some 200 yards S.W. of No. 7 gauge, and about 200 yards therefrom. The College standard gauge stands close to gauge No. 33.

At this stage in the experiment it would only appear necessary to point out what is being done and present a short summary of results to date, the data being at present but meagre.

For convenience the registered rainfall is charted. The appended charts show—(Chart 1) *a typical storm rain*, recorded 4th December. No better example could be given as showing the great variation in amount of rain received on the farm; in this case, 0—123 points. Gauges 44 and 45 showed respectively 123 and 54 points; these gauges being approximately ½ a mile apart.

Chart 2 shows another storm on 19th November. In this case the heaviest rain fell to the S.E., and, not as in the case of Chart 1, on the S.W. In each case the College Farm was apparently on the outskirts of the storm cloud; in that of Chart 1 it lay to the N.W. of us; in that of Chart 2 to the S.W. In the latter case our cultivated crops and experimental plots received but little rain. Most of our thunderstorms travel from W. to N.E. down the river. In many cases we lie just on the edge of the fall; indeed the fall in Richmond (1½ mile N.) is frequently much heavier, whilst it often rains in the river valley (Hawkesbury) 1 mile further north when no rain is falling on the farm.

Chart 3.—Result of steady S.S.W. and S.S.E. rain of a showery nature, recorded 17th December; variation 60—80 points. Gauge 31 is in a somewhat protected situation, and usually receives less rain than its neighbours. It may be noted that as yet we have had no southerly rains to record. All rains during the last three months of 1902 were accompaniments of thunder possibly with the exception of that on 16th December.

Charts 4, 5, and 6 give total rainfall at each gauge for October, November, and December in comparison with that of standard gauge.

INSTANCES of Daily Variation at Contiguous Gauges.

| Recorded dates. | | | | | | | Extreme variation. | |
|---|---|---|---|---|---|---|---|---|
| Oct. 29.—Gauges ... ... | No. 1 | 2 | 3 | No. 30 | 31 | 32 | No. 2 | 42 |
| Rainfall in points | 85 | 70 | 81 | 84 | 71 | 79 | 70 | 101 |
| Dec. 18.—Gauges ... ... | No. 1 | 2 | 3 | No. 30 | 31 | 32 | No. 31 | 42 |
| Rainfall in points | 113 | 96 | 114 | 113 | 71 | 112 | 71 | 124 |
| Dec. 8.—Gauges ... ... | No. 1 | 2 | 3 | No. 30 | 31 | 32 | No. 43 | 7 |
| Rainfall ... | 85 | 85 | 85 | 92 | 91 | 91 | 79 | 45 |

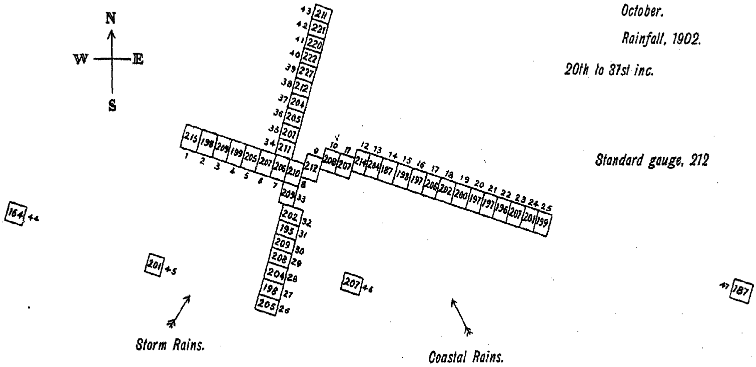
It will be seen from the above few figures illustrating daily variation that it may be considerable at contiguous gauges; which are 69 yards 2 feet apart.

Gauges 2 and 31 showed considerable variations as compared with the neighbouring gauges; it is singular that the same gauges show up similar extremes of variation on falls recorded 29th October and 18th December.

For comparison a fall recorded 8th December is given. The two gauges (2 and 31) showing low falls on the former occasions show this time no discrepancy. The position of these two gauges is such as

*H. A. College, Richmond.*

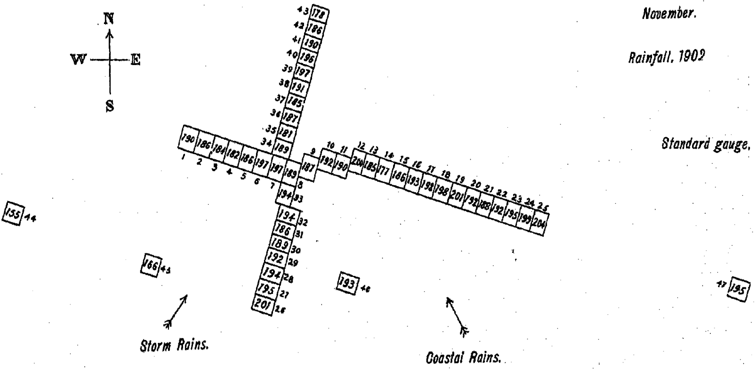
## CHART 4.



*October.*
*Rainfall, 1902.*
*20th to 31st inc.*

*Standard gauge, 212*

## CHART 5.

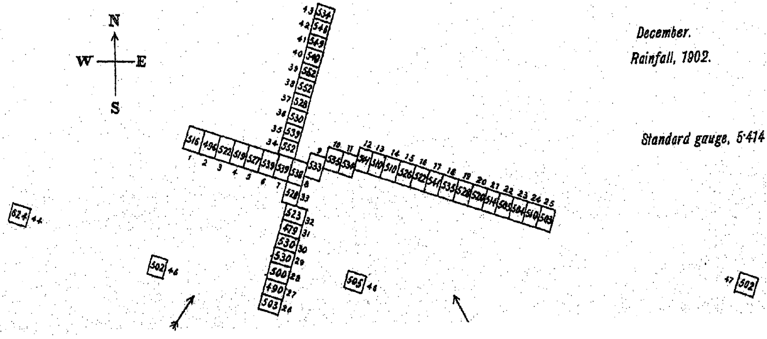


*November.*

*Rainfall, 1902*

*Standard gauge, 202*

## CHART 6.



*December.*
*Rainfall, 1902.*

*Standard gauge, 5·414*

would lead one to suspect it has something to do with the shortage. Under some winds it is quite likely this would be the case. Gauge 2 stands clear from obstacles on a slightly raised bank at edge of the orchard roadway, but it is immediately above an angle in the bank of one of the vegetable plots, the two sides of which run approximately N.N.E. and E.S.E. forming a right-angle, and with a steep bank 4 feet deep. The rains, however, on each of the three dates came from W.S.W. Eddying currents might well affect the amount caught, especially when rain comes from N.E., which, however, seldom occurs. Gauge 31 lies 15 feet to the S.E. of a panel fence, with a cottage at some short distance behind it, and doubtless, under some circumstances, wind will affect the amount of rain caught here. Still, at other times, no appreciable difference has been found in the results recorded.

From the few results obtained it can thus be shown that considerable variation occurs on 1 acre of ground; even in the case of heavy falls the two edges of an acre of ground, of a square form, might receive rain varying by 20 per cent. or more. An accumulation of such variations would mean an important factor in the fortunes of the plant inhabitants, which would be emphasised in cases of where plant water requirements were low with heavy rain or high with least rain, or where soils varied much in texture and in relation to water-carrying capacity.

The facts would seem to have an important bearing on agricultural work, and it is safe to say that no experimental work can be fully understood unless at the same time the rainfall of the area producing the plant under discussion is recorded in all its details; for plots as distant as some of those here show great differences in the amount of rainfall, and in the differing times at which it is received.

Crops placed near obstacles would seem likely to have capricious rainfall, as is hinted at in connection with our gauges 2 and 31.

It is pointed out by Dr. N. A. Cobb, who suggested this line of experimental work, that "whatever turns out to be the maximum difference at short distances, *that* is what experimenters must provide against in future. It will not do for them to 'run the chance' of the rainfall being equal, and *assume* that it *is* equal, if there is a possibility that it is unequal."

Further discussion in the matter is reserved for the accumulation of more data.

TABLE summarising Results.—October-December, 1902.

| | Extremes (in Points). | | Mean of 47 stations. | Standard gauge. Results supplied to Government Astronomer. | Variation for month. |
|---|---|---|---|---|---|
| 1902. | Lowest. | Highest. | | | |
| October (last twelve days of month only). | 164<br>gauge 44 | 227<br>gauge 39 | 204 | 212 | 18 per cent. |
| November ... ... ... | 155<br>gauge 44 | 204<br>gauge 25 | 190 | 202 | 24 ,, |
| December ... ... ... | 479<br>gauge 44 | 624<br>gauge 31 | 526 | 541 | 24 ,, |

TABLE showing Extent of various Falls.

| | Rain fell on days | 1-19 points. | 20-49 points. | 50-99 points. | 1 inch and over. |
|---|---|---|---|---|---|
| October (12 days) ... ... | 5 | 2 | 1 | 2 | ... ..... |
| November ... ... ... | 8 | 5 | 1 | 2 | ......... |
| December ... ... ... | 11 | 4 | 3 | 3 | 1 (116 points.) |

It will be observed that no "sub-soil rains" fell, though fine surface rains fell during early December.

## Field Experiments with Potatoes.

GEO. L. SUTTON,
Experimentalist.

THE past season has been an unfavourable one for field experiments with potatoes owing to the unsuitable weather conditions which prevailed during the growing period. There was not sufficient rain during the winter to saturate the subsoil, and the light showery weather experienced in spring seemed to cause abundant top growth without corresponding root development. The light showers in October, were followed by excessive heat in November, which caused all the varieties to mature prematurely; some of the early varieties were quite mature on November 21, much earlier than is usual in this district. The heat during November was unseasonable, this mean temperature for the month, 72·32, degrees being the highest recorded since meteorological observations have been taken at this College.

The rains which fell in December were too late to be of any great benefit, as most of the varieties at this time were almost mature.

The following experiments were carried out.

I. Trials of planting at different depths.
II. Fertiliser trials.
III. Test of varieties.

The plot chosen for the experiments was one of the large field plots 4 acres in area, the dimensions being in length 10 chains, width 4 chains. The plot was almost level, the soil was uneven in character, ranging from a poor pipeclay loam to a very fair red sandy loam. In order to take in as many inequalities of the soil as possible and to have the trials conducted under fairly similar conditions, the plots under trial consisted of one or more single drills, which ran the whole length of the plot. Whenever possible the plots—drills—to be compared were adjacent to each other but when from some cause this was impossible, they were located as close to each other as circumstances would admit.

The drills were 4 links—about 2 feet 7 inches—apart. In the 4 acres there were just 100 drills, so that each drill was $\frac{1}{25}$ of an acre.

The previous crop on this land was—field peas eaten off by sheep in 1901; in February, 1902, mangolds were planted but owing to want of rain failed to germinate.

Early in the Spring of 1902, farm-yard manure at the rate of 10 tons per acre was spread over the land. The ground was then ploughed 8 inches deep, and subsoiled another 4 inches by a disc plough, with subsoil attachment, it was then brought to a fine tilth by harrowing and rolling.

The drills were drawn out with a double mould broad drill plough.

The sets, cut as uniformly as possible, were planted at the bottom of the furrows, and were lightly covered by a lever harrow, with the teeth set slanting to the rear.

Before planting, 500 lb. of the following fertiliser—nitrate of soda 30 lb., blood 150 lb., superphosphate 220 lb., sulphate of potash 100 lb.—was sown in all the drills, except those of Expt. III, by means of the Farmer's Friend fertiliser drill. It was thoroughly mixed with the soil in the furrow by a wide cultivator tooth attached to the rear of the implement; this attachment also loosened the soil in the bottom of the drill, leaving it in a fine mellow condition for the set to rest in. The subsequent cultivation gradually filled in the furrows until the surface of the soil became level; only those drills requiring hilling for comparison in Expt. I were hilled, the remainder were cultivated on the flat. Planting commenced on September 4, and was completed on September 28.

## Experiment I.—Shallow Planting *v.* Deep Planting.

Two depths for planting were compared, viz., 4 inches, or shallow planting, and 6 inches, or deep planting. These depths were chosen because 4 inches is the customary depth to plant potatoes in this district, and 6 inches was found to be as deep as it was possible to plant with the ordinary farm implements. Plots planted at each depth were cultivated on the flat and hilled for comparison.

Variety of potatoes used, Brownell's Beauty.

In this trial, owing to some drills being hilled, it was impossible to have the plots for comparison adjacent to each other. They were, however, located as near to each other as their method of cultivation would allow.

The results were as follows :—

*Shallow* v. *Deep Planting.*

| No. of Plot. | Depth of Planting. | Hilled or Not Hilled. | Yield per Plot. | Yield per Acre. | Increase per Acre. |
|---|---|---|---|---|---|
| | inches. | | cwt. qrs. lb. | tons cwt. qrs. lb. | tons cwt. qrs. lb. |
| 16 | 4 | Not hilled ... | 1 1 10 | 1 6 0 13 | ............ |
| 20 | 4 | ,, ... | 0 3 0 | | |
| 14 | 6 | Hilled .. ... | 1 2 0 | 2 4 2 16 | 0 18 2 3 |
| 18 | 6 | ,, ... ... | 2 0 8 | | |
| 23 | 4 | ,, ... ... | 1 2 0 | 1 15 2 24 | ............ |
| 27 | 4 | ,, ... ... | 1 1 12 | | |
| 25 | 6 | Not hilled ... | 1 3 6 | 2 10 0 0 | 0 14 1 4 |
| 29 | 6 | ,, ... ... | 2 0 22 | | |
| 32 | 4 | Hilled ... ... | 1 1 12 | 1 10 3 6 | ............ |
| 34 | 4 | ,, ... ... | 1 0 12 | | |
| 33 | 6 | ,, ... ... | 1 3 2 | 2 10 0 25 | 0 19 0 19 |
| 35 | 6 | ,, ... ... | 2 1 0 | | |
| 38 | 4 | Not hilled ... | 1 1 0 | 1 9 3 18 | ... .... .. |
| 40 | 4 | ,, ... | 1 0 16 | | |
| 37 | 6 | ,, ... | 3 0 12 | 3 7 0 21. | 1 17 1 3 |
| 39 | 6 | ,, ... | 2 1 2 | | |

The results from this experiment show that better returns are obtained when the potatoes are planted 6 inches deep than when planted 4 inches deep.

By grouping and averaging the yields obtained in this experiment, the following results dealing with hilled and level cultivation were obtained:—

*Potatoes planted* 4 *inches deep.*

| Numbers of Plots. | Method of Cultivation. | Average Yield per Acre. | Increase per Acre. |
|---|---|---|---|
| | | tons cwt. qrs. lb. | cwt. qrs. lb. |
| 16, 20, 38, 40 | Level cultivation; not hilled ... | 1 8 0 1 | ......... |
| 23, 27, 32, 34 | Hilled ... ... ... ... ... | 1 13 1 1 | 5 1 0 |

*Potatoes planted* 6 *inches deep.*

| Numbers of Plots. | Method of Cultivation. | Average Yield per Acre. | Increase per Acre. |
|---|---|---|---|
| | | tons cwt. qrs. lb. | cwt. qrs. lb. |
| 25, 29, 27, 29 | Level cultivation; not hilled ... | 2 18 2 10 | 11 0 18 |
| 14, 18, 33, 35 | Hilled ... ... ... ... ... | 2 7 1 20 | ........... |

These results indicate that when the shallow method of planting is adopted, it is advisable and profitable to hill the plants at the last cultivation; if the deeper method of planting be adopted, it is unnecessary and unprofitable to hill them.

## Experiment II.—Fertiliser Trials.

This experiment was divided into three sections, as follows:—

A.—A trial to show the effect of omitting one or more ingredients of plant-food from a complete fertiliser.

B.—A trial of two nitrogenous fertilisers alone and in combination with each other.

C.—A trial to compare the value of phosphoric acid from different sources, when used alone and in combination with superphosphate.

The fertiliser for these trials was sown in the drill and mixed with the soil in the furrow by means of the Farmers' Friend fertiliser drill and attachment. Before sowing, each quantity of fertiliser for trial was made up to a certain fixed bulk by the addition of a considerable quantity of sand. The amount of this bulk had been determined previously by trials with the fertiliser drill, and was such a quantity as the implement would distribute whilst travelling the length of the plot, viz., 10 chains. In this manner the fertiliser was more evenly distributed than could be done by hand even by a very careful operator.

The variety of potato used in this experiment was Brownell's Beauty.

### *Section A.*

*A Trial to show the effect of omitting one or more ingredients of Plant Food from a complete Fertiliser.*

| No. of Plot. | Amount of Fertiliser per Acre. | | Yield per Plot. | Yield per Acre. | Increase. | Decrease. |
|---|---|---|---|---|---|---|
| | | lb. | cwt. qrs. lb. | tons cwt. qrs. lb. | cwt. qrs. lb. | cwt. qrs. lb. |
| 85 | None .. ... ... ... | | 1 3 6 | 2 5 0 10 | ............ | ......... |
| 84 | Nitrate of soda ... | 160 | 1 1 10 | 1 13 1 26 | ............ | 11 2 12 |
| 83 | Sulphate of ammonia | 120 | 1 2 0 | 1 17 2 0 | ............ | 2 2 20 |
| 82 | None ... ... ... .. | | 1 2 12 | 2 0 0 20 | ............ | ......... |
| 81 | Superphosphate ... | 320 | 1 2 6 | 1 18 3 10 | ............ | 1 1 10 |
| 80 | Sulphate of potash... | 160 | 1 1 0 | 1 11 1 0 | 6 1 0 | ......... |
| 79 | None ... ... ... ... | | 1 0 0 | 1 5 0 0 | ............ | ......... |
| 78 | Nitrate of soda ...<br>Superphosphate ... | 160<br>320 | 1 1 20 | 1 15 2 24 | 10 2 24 | ......... |
| 77 | Nitrate of soda ...<br>Sulphate of potash... | 160<br>160 | 1 0 24 | 1 10 1 12 | ............ | 1 1 10 |
| 76 | None ... ... ... ... | | 1 1 2 | 1 11 2 22 | ............ | ......... |
| 75 | Superphosphate ...<br>Sulphate of potash... | 320<br>160 | 1 2 0 | 1 17 2 0 | 5 3 6 | ......... |
| 73 | None ... ... ... ... | | 1 0 8 | 1 6 3 4 | ............ | ......... |
| 72 | Nitrate of soda ...<br>Superphosphate ...<br>Sulphate of potash... | 160<br>320<br>160 | 1 1 6 | 1 12 2 10 | 5 3 6 | ......... |

### *Section B.*

*A Trial of two Nitrogenous Fertilisers—Nitrate of Soda and Blood—alone, and in combination with each other, in varying proportions; the amount of Nitrogen supplied remaining constant.*

| No. of Plot. | Amount of Fertiliser per Acre. | | Yield per Plot. | Yield per Acre. | Increase. | Decrease. |
|---|---|---|---|---|---|---|
| | | lb. | cwt. qrs. lb. | tons cwt. qrs. lb. | cwt. qrs. lb. | cwt. qrs. lb. |
| 73 | None ... ... ... ... | | 1 0 8 | 1 6 3 4 | ............ | ........ |
| 72 | Nitrate of soda ..<br>Superphosphate ...<br>Sulphate of potash... | 160<br>320<br>160 | 1 1 6 | 1 12 2 10 | 5 3 6 | ........ |
| 71 | Nitrate of soda ...<br>Blood... ... ...<br>Superphosphate ...<br>Sulphate of potash... | 120<br>50<br>320<br>160 | 1 1 20 | 1 15 2 24 | 5 1 12 | ........ |
| 70 | None ... ... ... ... | | 1 0 24 | 1 10 1 12 | ............ | ........ |
| 69 | Nitrate of soda ...<br>Blood... ... ...<br>Superphosphate ...<br>Sulphate of potash... | 80<br>100<br>320<br>160 | 1 2 0 | 1 17 2 0 | 7 0 16 | ........ |
| 68 | Nitrate of soda ...<br>Blood.. ... ..<br>Superphosphate ...<br>Sulphate of potash... | 40<br>150<br>320<br>160 | 2 0 24 | 2 15 1 12 | 8 3 20 | ........ |
| 67 | None ... ... ... ... | | 1 3 12 | 2 6 1 20 | ............ | ........ |
| 66 | Blood... ... ...<br>Superphosphate ...<br>Sulphate of potash... | 200<br>320<br>160 | 1 2 24 | 2 2 3 12 | ............ | 3 2 8 |

*Section C.*

*A Trial to compare the value of Phosphoric Acid supplied by Superphosphate with that supplied by other sources; the amount of Phosphoric Acid supplied remaining constant.*

| No. of Plot. | Amount of Fertiliser per Acre. | | Yield per Plot. | Yield per Acre. | Increase. | Decrease. |
|---|---|---|---|---|---|---|
| | | lb. | cwt. qrs. lb. | tons cwt. qrs. lb. | cwt. qrs. lb. | cwt. qrs. lb. |
| 74 | Nitrate of soda<br>Thomas's phosphate<br>Sulphate of potash | 160<br>320<br>160 | 1 0 12 | 1 7 2 20 | 0 3 16 | ....... |
| 73 | None | ... | 1 0 8 | 1 6 3 4 | ......... | ......... |
| 72 | Nitrate of soda<br>Superphosphate<br>Sulphate of potash | 160<br>320<br>160 | 1 1 6 | 1 12 2 10 | 5 3 6 | ...... |
| 65 | Nitrate of soda<br>Blood<br>Superphosphate<br>Sulphate of potash | 160<br>75<br>320<br>160 | 1 0 26 | 1 10 3 6 | ........... | 5 3 6 |
| 64 | None | ... | 1 1 24 | 1 16 2 12 | ........... | ........ |
| 63 | Nitrate of soda<br>Blood<br>Superphosphate<br>Bone-dust<br>Sulphate of potash | 160<br>56<br>240<br>55<br>160 | 2 0 0 | 2 10 0 0 | 13 1 16 | ......... |
| 62 | Nitrate of soda<br>Blood<br>Superphosphate<br>Bone-dust<br>Sulphate of potash | 160<br>37½<br>160<br>110<br>160 | 1 2 0 | 1 17 2 0 | ........... | 13 1 4 |
| 61 | None | ... | 2 0 8 | 2 11 3 4 | ........... | ........ |
| 60 | Nitrate of soda<br>Blood<br>Superphosphate<br>Bone-dust<br>Sulphate of potash | 160<br>19<br>80<br>165<br>160 | 2 1 4 | 2 17 0 16 | 5 1 12 | ......... |
| 59 | Nitrate of soda<br>Bone-dust<br>Sulphate of potash | 160<br>220<br>160 | 2 0 0 | 2 10 0 0 | 2 2 20 | ....... |
| 58 | None | ... | 1 3 16 | 2 7 1 8 | ........... | ......... |
| 57 | Nitrate of soda<br>Superphosphate<br>Sulphate of potash | 160<br>320<br>160 | 2 1 12 | 2 18 3 20 | 11 2 12 | ........ |
| 56 | Nitrate of soda<br>Superphosphate<br>Rock phosphate<br>Sulphate of potash | 160<br>240<br>37½<br>160 | 2 1 22 | 3 1 0 18 | 1 1 10 | ......... |
| 55 | None | ... | 2 1 16 | 2 19 3 8 | ........... | ......... |
| 54 | Nitrate of soda<br>Superphosphate<br>Rock phosphate<br>Sulphate of potash | 160<br>160<br>75<br>160 | 2 1 12 | 2 18 3 20 | ........... | 0 3 16 |
| 53 | Nitrate of soda<br>Superphosphate<br>Rock phosphate<br>Sulphate of potash | 160<br>80<br>112<br>160 | 1 3 8 | 2 5 2 4 | ........... | 0 3 16 |
| 52 | None | ... | 1 3 12 | 2 6 1 20 | ........... | ........ |
| 51 | Nitrate of soda<br>Rock phosphate<br>Sulphate of potash | 160<br>150<br>160 | 2 0 12 | 2 12 2 20 | 6 1 0 | ....... |
| 50 | Nitrate of soda<br>Blood<br>Superphosphate<br>Sulphate of potash | 160<br>16<br>320<br>160 | 2 0 0 | 2 10 0 0 | ........... | 11 0 18 |

*Section C*—continued.

| No. of Plot. | Amount of Fertiliser per Acre. | | Yield per Plot. | Yield per Acre. | Increase. | Decrease. |
|---|---|---|---|---|---|---|
| | | lb. | cwt. qrs. lb. | tons cwt. qrs. lb. | cwt. qrs. lb. | cwt. qrs. lb. |
| 49 | None ... ... ... | | 2 1 22 | 3 1 0 18 | ........... | ......... |
| 48 | Nitrate of soda ...<br>Blood ... ...<br>Superphosphate ...<br>Bone charcoal ...<br>Sulphate of potash.. | 160<br>12<br>240<br>39<br>160 | 2 0 24 | 2 15 1 12 | ........... | 5 3 6 |
| 47 | Nitrate of soda ..<br>Blood ... ...<br>Superphosphate ...<br>Bone charcoal ...<br>Sulphate of potash.. | 160<br>8<br>160<br>78<br>160 | 2 2 12 | 3 5 0 20 | 18 1 6 | ......... |
| 46 | None ... ... ... | | 1 3 14 | 2 6 3 14 | ........... | ......... |
| 45 | Nitrate of soda ...<br>Blood ... ...<br>Superphosphate ...<br>Bone charcoal ...<br>Sulphate of potash.. | 160<br>4<br>80<br>116<br>160 | 2 1 4 | 2 17 0 16 | 10 1 2 | ........ |
| 44 | Nitrate of soda ...<br>Bone charcoal ...<br>Sulphate of potash.. | 160<br>155<br>160 | 1 2 16 | 2 1 0 8 | ........... | 5 3 6 |
| 43 | None ... ... ... | | 1 3 14 | 2 6 3 14 | ........... | ...... .. |

The results of this experiment cannot but be regarded as disappointing. Owing to various causes the results are not definite—in some cases are contradictory, rendering it impossible for reliable conclusions to be obtained from them.

## Experiment III.—Trial of Varieties.

This trial was intended to be a comparative one. With that object in view, alternate drills were planted with a variety of Early Rose, in order that the yield of each of the varieties under trial might be compared with the yield of a standard variety. Owing to the unfavourable season, and especially to the heat experienced during November, the variety chosen was almost an entire failure. On account of the unevenness of the soil, no accurate comparisons of the value of the varieties can be made by comparing their respective yields with each other.

The excessive heat in November caused most of the varieties to ripen together and prematurely, so that observations as to earliness had to be abandoned.

Small quantities only of the varieties being obtainable, the plots had to be small. They were uniform in size and occupied $\frac{1}{6}$ of a drill; they were $\frac{1}{200}$ acre in area. The sets, sixty-six in number, were cut to as nearly a size as possible, and were placed 15 inches apart. This trial was planted on September 4th, 1902. The whole of the varieties were fit to dig by the end of December, but digging had to be delayed until the first week in the new year. The names given are those under which the varieties were received. The yields are as follow, and will serve in some degree to indicate what varieties are likely to prove suitable for this district.

*Trial of Varieties.*

| Plot No. | Name of Variety. | Seed obtained from— | Date when dug. | Yield per acre. | Remarks. |
|---|---|---|---|---|---|
| | | | | t. c. qrs. lb | |
| 87 | Brownell's Beauty ... | J. Bridge & Co... | 6/1/03 | 2 12 0 1 | |
| 91 A | Lord Tennyson... ... | Yates & Co. ... | 21/11/02 | 1 3 0 22 | No second growth. |
| 91 B | Red Skin Flourball ... | Anderson & Co. | 4/12/02 | 1 13 0 22 | Nicely shaped potato, good colour. |
| 91 C | Imperator ... ... | ,, ,, ... | 6/1/03 | Not estimated. | Badly shaped potato. |
| 91 D | Satisfaction ... ... | ,, ,, ... | 6/1/03 | 4 0 1 12 | Prolific: roots good size, shape, and colour. |
| 91 E | Adirondack ... ... | Yates & Co. ... | 6/1/03 | 3 6 0 8 | A good marketable potato. |
| 91 F | Scotch Grey ... ... | ,, ,, ... | 6/1/03 | 1 13 3 20 | Runs to strings. |
| 81 G | The Bruce ... ... | ,, ,, ... | 6/1/03 | 3 18 2 8 | Runs to strings; prolific, but potatoes too small for market. |
| 91 H | Circular Head ... ... | ........... | 6/1/03 | 17 3 12 | Poor growth; runs to strings. |
| 93 A | Snowflake ... ... | Anderson & Co. | 6/1/03 | 1 17 2 0 | Fair bearer, but runs to strings, |
| 93 B | Australian Monarch ... | Yates & Co. ... | 6/1/03 | No record. | A sound, large, white, nicely-shaped potato. |
| 93 C | Avoca ... ... ... | ,, ,, ... | 6/1/33 | 2 8 0 24 | Dark blue in colour, nice shape, but rather small. |
| 93 D | Breese's Prolific ... | Anderson & Co | 6/1/03 | Not estimated. | Germinated badly; subject to second growth. |
| 93 E | Breese's Peerless ... | ,, ,, ... | 6/1/03 | 3 2 2 0 | Vigorous growth; large, white potato. |
| 93 F | White Elephant ... | Brunning, Melb. | 6/1/03 | 1 6 3 4 | Immense tops; runs badly to strings. |
| 93 G | Magnum Bonum ... | Anderson & Co. | 6/1/03 | Not estimated. | Germinated badly; growth poor and very uneven. |
| 93 H | Fidler's Reading Giant | Yates & Co. ...... | 6/1/03 | 2 13 2 8 | Vigorous top growth; roots run to strings; potatoes too small for market. |
| 95 A | Red Beauty of Hebron | Anderson & Co. | 6/1/03 | 1 12 3 5 | Vigorous top growth. |
| 95 B | White Beauty of Hebron | ,, ,, ... | 21/11/02 | 2 1 0 8 | Good croppers; nice oval shape; dark white colour. |
| 95 C | Extra Early Ruby ... | ,, ,, ... | 6/1/03 | Not estimated. | This was a mixed sample. The E.E. Ruby is a really good sort, a good colour, and a good shape. |
| 95 D | Queen of the Valley ... | Yates & Co. ... | 6/1/03 | ,, ... | Germinated badly; not enough plants to estimate yield; evidently a good variety and fair cropper. |
| 95 E | Pink-eye ... ... ... | Brunning, Melb. | 6/1/03 | 1 12 0 16 | No marketable potatoes, runs badly to strings. |
| 95 F | Exeter Russet ... ... | Yates & Co. ... | 6/4/03 | 1 17 2 0 | Runs badly to strings. |
| 95 G | Reading Russet ... | ,, ,, ... | 6/1/03 | Result lost | |
| 95 H | Up-to-date ... ... | Anderson & Co. | 6/1/03 | 2 6 1 20 | A good cropper, but potatoes small, hardly large enough for market. |
| 97 A | Cambridge Kidney ... | Yates & Co. ... | 6/1/03 | Not estimated. | Germinated badly; shy bearers, but does not run to strings. |
| 97 B | Myatt's Ashleaf Kidney | Anderson & Co. | 19/12/03 | 1 3 3 4 | A large number of potatoes at root, but much too small for market, |
| 97 C | Early Puritan ... ... | Yates & Co. ... | ... .. | No record | Germinated very badly. |
| 97 D | Burpee's Extra Early... | Brunning, Melb. | 23/12/02 | 3 11 1 20 | Generally twelve and fourteen potatoes under one root, but rather small for market. |
| 97 E | Carman No. 1 ... ... | ,, ,, ... | 11/12/02 | 3 7 3 12 | A splendid variety; a fine, large, clean marketable potato. |
| 97 F | Extra Early Vermont.. | ,, ,, ... | 23/12/03 | 3 2 2 0 | A splendid variety, nearly all potatoes marketable size, clean, and good shape. |
| 97 G | Herd Laddie ... ... | Yates & Co. ... | 21/11/02 | 1 15 2 24 | Large number of small potatoes at root; blue colour, skin tough. |
| 97 H | Manhattan ... ... | Anderson & Co. | 6/1/03 | Not estimated. | Germinated badly; potatoes fair size. |

Satisfaction, Carman No. 1, Burpee's Extra Early, Adirondack, and Extra Early Vermont are the varieties giving most promise of being suitable for this climate. The variety called Satisfaction deserves special mention. Several roots of this variety were found growing amongst the main crop of Brownell's Beauty. Their prolificness in each case was quite remarkable. It is interesting to note in connection with this variety that potatoes imported from Tasmania under the name of "Tasmanian Pink-eye" appear to be identical with the variety grown here as Satisfaction.

# QUANTITY MEASUREMENTS OF HAYSTACKS, DAMS, &c.

CUTHBERT POTTS,
Lecturer in Chemistry and Physics, H. A. College.

THE following directions are the result of a letter of inquiry on this subject handed to me by the Principal of the College, and I hope that farmers will find this article of some value to them.

## Measuring Haystacks.

The first question to be considered in this matter is how to find accurately the volume of the stack.

There are several short methods of doing this; but none of them are very accurate, and, further, these short methods have the disadvantage of having to be altered to suit each separate shape of stack.

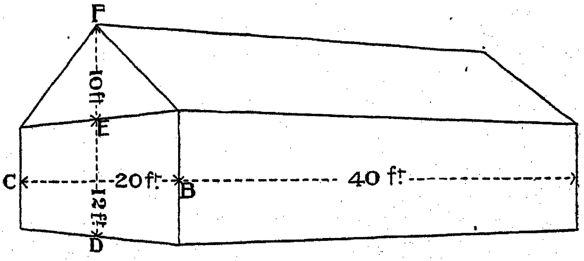


Fig I

One of the most usual short methods for rectangular stacks, the top having vertical ends, is as follows (Fig. 1):—

Measure the length (A to B, example 40 feet), and the width (B to C, example 20 feet) of the stack half-way between the ground and the eaves.

Measure the height from the ground to the eaves (D to E, example 12 feet), and also the height from the eaves to the ridge (E to F, example 10 feet).

To find the volume of the stack, add the height from the ground to the eaves to one-half the height from the eaves to the ridge. This is the average height of the stack. Multiply the length by the width, and this result by the average height. This will be the volume of the stack. If all measurements are made in feet the volume is found in cubic feet.

*Example*—

10 divided by 2 = 5 = one-half the height from E to F.
12 + 5 = 17 = average height.
40 × 20 × 17 = 13,600 cubic feet.
This is the volume of the stack.

The above method is only accurate when the length and width at the ground is the same as the length and width at the eaves. It is only roughly accurate when, as is the case with most stacks, the top is larger than the bottom. Further, if the stack is circular, with conical top, or if the stack is rectangular, and the ends of the top are sloped, the above method becomes more inaccurate.

The method outlined above is, however, largely used, and has, on this account, been described here. But I do not recommend its use, advising rather the use of the following method, which is only slightly longer and very little more difficult to work, and which has the great advantage of being accurate for all shapes of stacks. In fact, it is a method that can be used to find the volume of any figure, provided the top is parallel to the bottom and the sides are bounded by straight lines. This, it will be seen, includes the estimation of the contents of stone heaps, dams with batter sides, &c. The method consists of two parts :—

(1.) To find the volume between the eaves and the ground.
(2.) To find the volume between the eaves and the ridge.

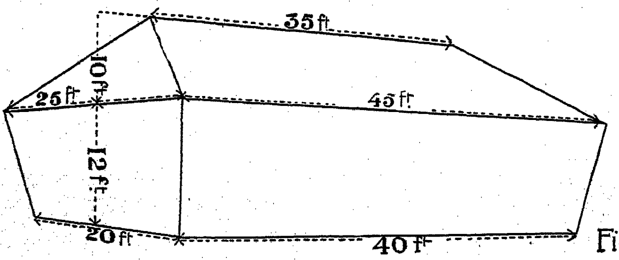


Fig 2

Referring to Fig. 2, we have a rectangular stack with sloping ends to the top.

To find the volume :—

Measure the length and the width at the ground. (Example, 40 and 20 feet.)
Measure the length and the width at the eaves. (Example, 45 and 25 feet.)
Measure the length of the ridge. (Example, 35 feet.)
Measure the height from the ground to the eaves (Example, 12 feet).
Measure the height from the eaves to the ridge (Example, 10 feet).

To find the volume between the ground and the eaves :—

Multiply length at ground by width at ground (1).
Multiply length at eaves by width at eaves (2).
Multiply sum of lengths by sum of widths (3).

Add 1, 2, and 3 together, and multiply the sum by height from ground to eaves, and divide this result by 6. This will be the volume of the stack below the eaves.

*Example.*—

40 × 20 = 800 (1)
45 × 25 = 1,125 (2)
95 × 45 = 4,275 (3)
6,200 = sum of 1, 2, and 3.
6,200 × 12 = 74,400
74,400 ÷ 6 = 12,400 cubic feet = volume of stack below eaves.

To find the volume above eaves:—

Multiply the length at eaves by width at eaves (1).

Add length of ridge to length at eaves and multiply by width at eaves (2).

Add 1 and 2 together, and multiply the sum by height from eaves to ridge, and divide this result by 6. This will be the volume above the eaves.

*Example.*—

45 × 25 = 1,125 (1)
35 = length of ridge.

80 × 25 = 2,000 (2)

3,125 = sum of 1 and 2.
3,125 × 10 = 31,250
31,250 ÷ 6 = 5,208⅓ cubic feet = volume above eaves.

The total volume of the stack is the sum of these two volumes—12,400 + 5,208⅓ = 17,608⅓ cubic feet.

If this stack had been estimated by the first method, the volume would have been 16,256¼ cubic feet, a difference of 1,352 cubic feet; and this would make a difference of about 3 tons in weight.

To find the tonnage of the stack:—Having found the number of cubic feet in the stack, we only want the weight per cubic foot to find the tonnage. Unfortunately, the weight of a cubic foot of hay is very variable, and depends on a vast number of different circumstances, the chief of which are:—

(1) Size of stack.
(2) Age of stack.
(3) Condition of hay.

As the result of a large number of careful calculations, the following numbers have been given for finding the tonnage of a haystack:—

(1) If the stack extra large and hay good and loose, or if stack large and well sunk, take 400 cubic feet per ton.

(2) If stack large and hay good and loose, or if stack fairly large and well sunk, take 500 cubic feet per ton.

(3) If stack fairly large and hay good, loose, and with long stalks, or if stack small and very well sunk, take 600 cubic feet per ton.

Intermediate numbers will often be necessary, and in special cases numbers less than 400 or greater than 600 will be required. For example, if the stack is small and hay loose, rather over-dried, and with extra long stalk, it is quite possible that 1,000 or more cubic feet will be necessary to make a ton of hay. It is only experience that will enable one to decide accurately the proper number to be used.

On this account I would recommend farmers to adopt the somewhat longer, but more accurate, method of cutting out a truss of hay from about half-way up the stack (the stack being more compressed at the bottom than at the top), and, after carefully measuring it to find its cubic content, to weigh it, and from this to calculate the weight of a cubic foot. If this is done, the following table will be found of advantage :—

| 1 cub. ft. of hay weighs— | | Cub. ft. per ton. |
|---|---|---|
| 7 lb. 8 oz. | take | 300 |
| 6 lb. 6 oz. | „ | 350 |
| 5 lb. 10 oz. | „ | 400 |
| 5 lb. | „ | 450 |
| 4 lb. 8 oz. | „ | 500 |
| 4 lb. | „ | 550 |
| 3 lb. 11 oz. | „ | 600 |
| 3 lb. 7 oz. | „ | 650 |
| 3 lb. 3 oz. | „ | 700 |

Occasionally, circular stacks are built. In this case —
Measure the distance round the bottom of the stack.
Measure the distance round the eaves.
Measure the vertical heights as before.

To find the volume of the lower part of the stack—
Multiply the distance round the bottom by itself and this by $\frac{7}{88}$ (1).
Multiply the distance round the eaves by itself and this by $\frac{7}{88}$ (2).
Add the two distances together, and multiply this sum by itself and this by $\frac{7}{88}$ (3).
Add 1, 2, and 3 together and multiply by $\frac{1}{6}$ the height from the ground to the eaves.
To find the volume of the upper part of the stack—
Multiply 2 by $\frac{1}{3}$ the height from the eaves to the peak.

## Estimating Capacity of Dams, Stone-heap, &c.

The method used above to find the volume of the lower part of the stack can equally be applied to finding the volume of a stone heap (Fig. 3), or of a dam (Fig. 4). A word is necessary in the case of the dam. To find the total capacity of the dam, the top measurements are made along the line of highest possible water level, the bottom measurements are made along the sides of the bottom, and the vertical height is measured from the bottom to the highest water level.

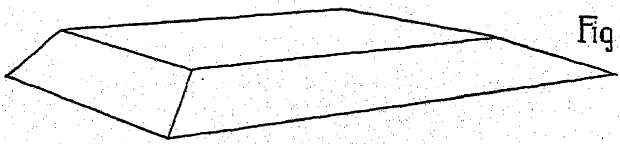


Fig 3

In order to find the quantity of water in the dam at any time, it is necessary to have the length and width of the bottom (these should have been taken when the dam was empty, and a record of them made). The top measurements are made along the sides of the level of the water. The depth of the water can always be found by taking a pole and placing it vertically in the water, so as to rest on the bottom of the dam.

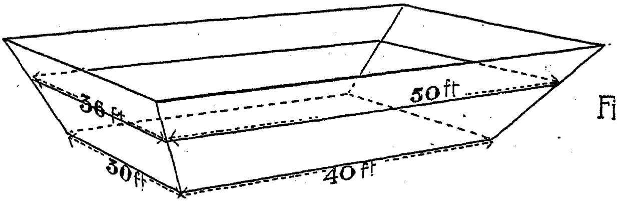


Fig 4

*Example.*—

Length at bottom, 40 feet ; width 30 feet.
Length at water level, 50 feet ; width, 36 feet.
Depth of water at time of estimation, 6 feet.
40 × 30 = 1,200 (1)
50 × 36 = 1,800 (2)
93 × 66 = 5,940 (3)

8,940 = sum of 1, 2, and 3.
8,940 × 6 = 53,640.
53,640 ÷ 6 = 8,940 cubic feet.

NOTE.—One cubic foot of water weighs 62·5 lb. and equals 6¼ gallons.

This article has been written for farmers, to enable them to make certain necessary calculations. I have endeavoured throughout to describe the methods as simply as possible, so that all who understand the simplest rules of arithmetic can follow the calculations.

Here I have dealt with only one class of quantity estimation necessary in farm life ; but I feel sure that there must be many other kinds of measurement that the farmer would like to be able to make for himself. I shall be pleased, if notified of any special cases, to supplement this article with others, dealing, where possible, with simple methods of quantity estimation.

## A NEW DISEASE IN HONEY-COMB.

IN October last, Mr. F. S. McDade reported the occurrence in the Forbes District of a disease which affected the comb in bee-hives. Bee-keepers of twenty years' experience in the district had seen nothing like the trouble before, and, as an instance of the disastrous effects of the disease, it was stated that out of 100 hives in splendid order, in a short time after the outbreak only three remained.

Mr. Gale examined the specimens forwarded, but was unable to identify the disease, which he regarded as a new one so far as this State is concerned. It was, therefore, determined to have the matter thoroughly investigated at the Hawkesbury Agricultural College by Mr. Principal Potts and Mr. Gale. The following progress report has been submitted by them :—

The three samples of diseased comb forwarded by Mr. McDade were found on examination to be affected with the same disease, all showing physical and pathological characteristics of a similar nature.

A careful examination was made to determine the ordinary physical conditions in comparison with the well-known disease foul-brood, and healthy comb. It was considered best to tabulate these to aid bee-keepers in readily detecting the earliest symptoms of this disease, and to differentiate it from foul-brood :—

| Foul-brood. | New disease. | Healthy comb. |
|---|---|---|
| 1. The cappings or coverings of the brood cells are of a dark or chocolate colour, with the surfaces sunken or depressed in the latter stages of the disease. | Ditto ...................... | The cappings are convex or raised, and their colour whitish or stained yellow. |
| 2. The cappings are frequently perforated. | Ditto ................. .... | The cappings are completely sealed. |
| 3. The larvæ or grubs range in colour from yellow to dark brown or chocolate. | The larvæ or grubs are light brown only throughout their growth. | Pearly white. |
| 4. The larvæ become decomposed as the disease progresses, and end in a shapeless glutinous mass. | The larvæ decomposes, but the shape is retained in dry form, and is always recognisable. | Shape and colour normal throughout. |
| 5. The decomposed mass in the cell is stringy and adhesive. | The decomposed portion of the larvæ is dry, and not stringy. | The fluids in the grub are normal, creamy, and sweet. |
| 6. A strong offensive smell is present, and can be readily detected near the diseased hive. | The odour is only slight, and of treacle-like fragrance. | Slight waxy odour. |
| 7. The bees fail to collect and preserve honey, and the work of the hive ceases. | Ditto ...................... | The bees work well throughout. |

A bacteriological examination disclosed the presence of a motile liquefying parasitic bacterium, similar in several characteristics to the micro-organism known to create foul brood (*Bacillus alvei*).

This bacillus was found distributed throughout the interior of the infected cells in the comb, and in the fluids of the larval abdomens in all stages of growth. In some cases, where the grub was not more than thirty hours' developed from the egg stage, this micro-organism was present and the grubs or larvæ dead. In fact, in every stage of development of the immature bee the disease was manifested.

It will be necessary to conduct further tests to determine more fully the life-history of this organism. Sufficient data, however, have been secured to demonstrate its virulent pathogenic character.

### *Cause of the Disease.*

Many micro-organisms of a harmless nature are found associated with bee-life in its various stages. Recent researches prove that where bees are neglected and starved, creating a low vital-resisting power, these parasitic organisms assume a virulent pathogenic, or disease producing form.

It has to be remembered that last winter was generally throughout the State most unfavourable for bees. There was an absence of bee food and general weather conditions were of a depressing kind. Where no attention was given to the bees, the absence of natural food, and the failure to provide them with artificial nourishment, the conditions suitable to the development of this disease producing organism became available.

Given a hive of well bred bees, healthy, well fed, and the sanitary state of the hive attended to, they are enabled to resist the invasion or development of disease-producing germs.

### *Treatment.*

It is possible to destroy the *bacilli* by various antiseptics or heat, but their seeds, or spores, are highly resistant. Their vitality cannot be restrained, and when favourable conditions prevail the disease will appear from fresh centres of infection. Under the circumstances, and with a knowledge of the virulence of the disease and the rapidity of its action it is best to effect the complete destruction of the hive.

A constant watch should be kept over the brood cells during the prevalence of bad weather and a low class food supply. On the appearance of a few affected cells remove the bees from the hive containing the diseased larvæ. Keep them for two days without food and then put them in a clean hive with starters. The old frames with larvæ should be destroyed by fire.

Where the hive is generally affected close the entrance after dark, apply bisulphide of carbon to suffocate the bees and destroy hive and bees by fire.

Bisulphide of carbon is very inflammable and poisonous, and great care should be taken in using it. With care the destruction can be effectually carried out by fire alone.

As before mentioned, the droughty state of past seasons has had most to do with the development of bee diseases in general, especially such as this under review. It is well known amongst practical bee-keepers that when bees are dwindling, or being rapidly decimated by the various diseases bees are heir to, that no sooner is there an increased honey flow, than diseases diminish in proportion to the activity of the flow. It must be understood that bees are not at all fastidious in their tastes as regards the flavour of honey they store. Bees gather for their own consumption, and not for that of man. They will pass over better flavoured honey to gather from those honey producing plants that are giving a greater yield, although it may be of an unmarketable quality. Honey that is deleterious to us is not so to the little workers. Therefore, if when honey of an inferior quality is being gathered, it should be extracted and stored to feed back in seasons of a diminished supply.

Starvation is one of the most fruitful sources from which bee diseases are developed. We therefore strongly recommend that at all times, more especially during the winter months, all bees should be well supplied with their natural food-honey. By so doing the dangers associated with this new disease as well as those of a similar type will be greatly minimised, if not entirely prevented.

# NOTES ON COW-PEA.

C. T. MUSSON.

## 1. Root Galls.

FIG. 1 shows root galls common on many plants, exceptionally so on cow-pea, for which the thread worms causing the trouble have a great liking.

The worm, a small Nematode or thread worm (*Tylenchus arenarius*), enters the root from the soil, and, living within the tissues, causes by the irritation there set up the formation by the plant of these knot-like galls or swellings. At first these galls are sound, and on opening them the small pear-shaped transparent worm can be often found, a stage when it is full of eggs. The mature worm, which is truly worm-like in form, is to be found plentifully in the older galls when rot has set in, the eventual result of attack being complete decay of the root, and consequent death of the plant. Possibly, however, this may not occur until the pods, or some of them, have ripened sufficiently to harvest.

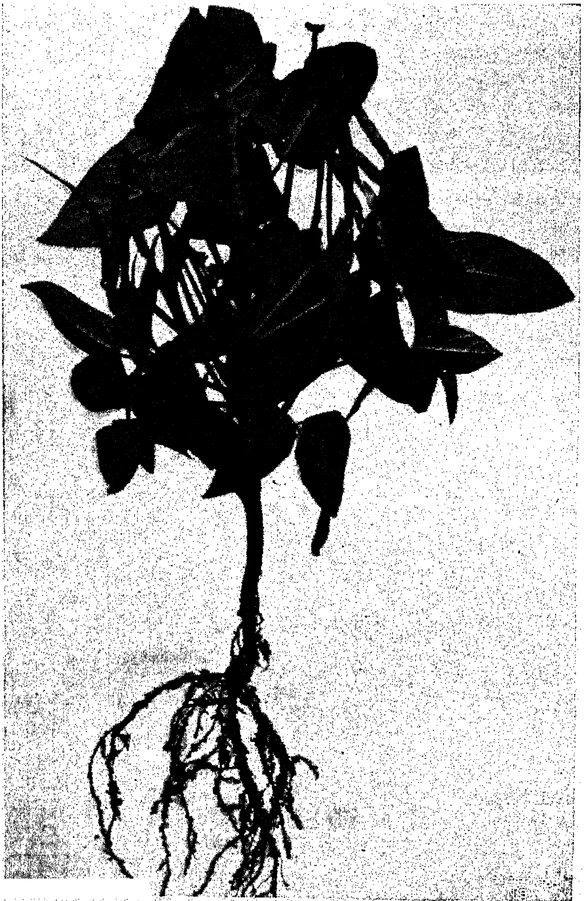


Fig. 1.

At the College farm many plants are attacked—garden and field crops, orchard trees and weeds—the favourite food being cow-pea and sugar beet, whilst potatoes are badly attacked at times. Take-all in wheat has been at times traced to this pest. Once in the land an effort should be made to get rid of them. The treatment adopted must be such as is considered most suitable under the special local requirements. There is really no practical remedy likely to stamp them out. We may hope, however, to reduce them in numbers, and so cause a minimum of loss. We are as yet in the dark as to whether any varieties of cow-pea are to any extent gall-proof, though, owing to their behaviour under attack, there is reasonable hope that some do not suffer so severely as others. For instance, Fig. 1 shows a plant apparently healthy above ground, the roots, however, being covered with galls. In some plots at the College farm there were to be observed cow-peas in one row suffering badly, while those in other rows, although attacked, showed no special above-ground indications. Moreover individuals, as in other plants, vary immensely, and may inherit resisting properties. This subject is under special investigation. Late advices from U.S.A. point to a variety called "Iron" as specially resistant.

The best plans to be adopted, out of many, in order to obtain relief, are:—

1. Application of lime in large quantities.
2. Starving them out, by keeping the land quite clear of vegetation, whether weeds or crops, for at least a full season. Possibly this would not entirely get rid of them, unless the bare fallowing be extended over a second season, as root fibres or vegetable matter of any kind would serve to keep them alive.
3. Trapping is perhaps the most efficacious means of coping with them. Suitable trap plants (cow-pea or sugar beet) being sown, and pulled carefully after the worms have had time to find their way into the roots. The worms would die in the roots as they dried, or some means could be adopted to quickly destroy them (cut off and burn, for instance). By ploughing up early the infested crop, the roots would be destroyed, and with them the worms.
4. Sowing of chemical manures with the seed acts as a repellant.

Finally, it may be said that every effort should be made to prevent the spread of these eel-worms, in preventing the careless dumping of galled plants anywhere about the place, and in practising careful rotation. The infected area should be quarantined as strictly as possible with these ends in view.*

## 2. Bacterial Root—nodules of Cow-pea.

The ordinary bacterial nodules of leguminose plants occur on cow-pea. With us, although this plant has been grown for some years, the nodules are not so plentiful as on some other legumes; notably, bean, pea, white clover, flat pea (*Lathyrus*), crimson clover, and others. (See Fig. 2.)

These nodules occur sparingly all over the roots, varying in size up to $\frac{1}{32}$ of an inch on rootlets, whilst on main roots they are occasionally as much as ¼ inch or more in diameter. They have pink centres, and can thus readily be distinguished from the eel-worm galls. They have also more the nature of spherical or rounded masses of tissue attached to the root by only a small portion of their area.

---

* References—*Agricultural Gazette*, Vol. I, p. 155, and Sept., 1901.

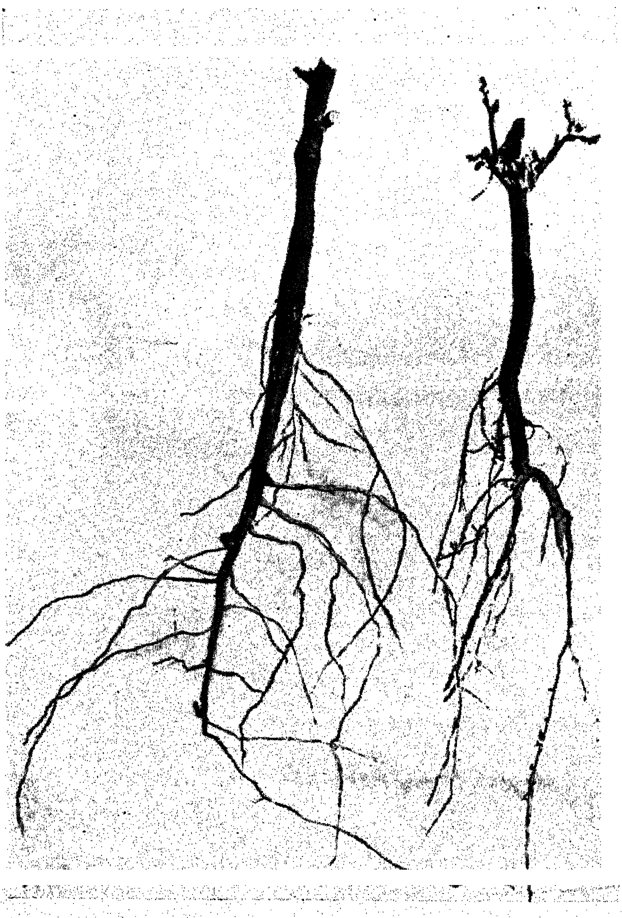


Fig. 2.

Their presence may be taken as an indication that suitable conditions of soil prevail, for plants possessing them are found not to require applications of nitrogeneous manures, or to only a very small extent: we are, therefore, saved, in the case of cow-pea and other legumes, the expense of applying this most costly of all manures.

The nodules consist of special enlargements of plant tissue, within which live (in friendly relationship we believe with the host plant) immense numbers of minute organisms (called scientifically *Bacterium radicicola*) which use for food purposes nitrogen obtained from the air circulating in the soil. Green plants cannot use the aerial nitrogen, and in these nodule organisms being able to do so, they are conferring a distinct benefit upon the plant on which they live and upon us; for they store up within reach of the root tissues proper a supply of nitrogenous matter which can be, and is, made use of by the host plant.

Strange to say, these nodules with the peculiar circumstances surrounding their life-history are found, with but very few exceptions, only on legumes.

The organisms have their natural home in the soil, and enter the plant in the first instance through the root hairs; the organs which absorb from the soil water with food materials dissolved in it. Different legumes have apparently their own special nodule organism, though the difference must be slight, for they appear much the same to us whatever plant the source. These nodules on our legumes are therefore to be encouraged. Soil devoid of the special form required for any particular legume can be inoculated with a preparation of the organisms readily obtainable. In a rough and ready though small way this can be done by anyone taking a few of the nodules from any plant, crushing them well, and stirring in water to be made up to a quantity sufficient to sprinkle a little on the soil where crop is growing, and, of course, it must be white clover nodule for white clover, or lupin nodule for lupin, and so on.

The presence, therefore, of these nodules is a good sign, and they give us the reason why green manuring with legumes is a cheap way of increasing in the soil plant-food materials, especially nitrogen.

## HAWKESBURY DISTRICT FARM NOTES.

H. W. POTTS.

*Wheat.*—The outlook for early winter crops, so far, is not favourable. There is an absence of sufficient moisture to give the grain a start, and whilst it is essential to get in the greater portion of the wheat crop this month, the weather conditions are by no means encouraging. The best practice is, however, to get in the seed. Rain in abundance may fall at any time, and there is everything to be gained if the crop is in readiness to secure all possible advantage.

Early sowing is necessary either for grain or hay. Blount's Lambrigg and White Lammas have in the past given the most satisfactory yields for hay; the former is sluggish in maturing, thence ought to be sown early. Steinwedel or Allora Spring varieties will answer best for late sowing. The Macaroni Wheat will give heavy yields of grain.

*Oats.*—Again, early sowing is found to give the most satisfactory returns even with the risk of the seed lying dormant for some time in the dry soil. The earliest and most hardy varieties to sow are the Potato Oat and Algerian.

A combination of oats sown with barley or other cereals will produce a heavy forage crop, as, owing to the difference of habit in growth in point of quickness and stooling properties, the barley matures rapidly and will provide the most of the pasture during the early grazing period, and the oats will come on later and stool out freely, not only prolonging the grazing period, but having the second advantage of providing a relishable change in pasture. A crop of oats and peas,

---

*Reference—*Agricultural Gazette*, Vol. VII, p. 690.

1½ bushels of oats to 1 bushel of dun or gray field peas provides a heavy forage crop for dairy cattle in well balanced proportions as a general ration for milk yields.

*Rye.*—Owing to the palatable nature of the Emerald Rye and its rich succulence it has proved a most suitable winter variety and should be sown early in April. A light sandy or gravelly soil is best suited to its rapid growth. The quantity to sow should be 2 bushels to the acre and it should not be sown as deeply as wheat or barley. Where sheep are to be fattened a mixture of rye and rape have been found to be a most serviceable crop. It is essentially a cleansing crop and in that regard it is found very useful for winter forage to get rid of weeds and prepare the soil for potatoes, maize, field-roots or millets.

Where the soil is sandy the need for thorough cultivation is not excessive; light ploughing and harrowing to bring the land into fairly good tilth is required. In the absence of much moisture it will be best to harrow freely two or three times. The disc harrow is generally found to be the best implement. Usually no cultivation is wanted after the grain has been sown excepting in the early stages of its growth when light harrowing should be employed to promote growth and kill the weeds. It is a useful and nourishing fodder for sheep, cattle, and pigs.

*Barley* should be sown for grain and green food as well as hay this month. The skinless barley is early and hardy, and forms a splendid variety for fodder. It also may be sown in combination with oats, peas, or vetches, or wheat, oats, and peas. These crops when mixed form a valuable ration for milch cows.

*Sheep's Burnet.*—The past two seasons of drought have given us ample evidence of the drought-resistant characteristics of this useful sheep fodder. It stands close cropping particularly on limestone formations, and thrives well. The nutritious nature of this fodder is apparent during the early summer months. It ought to be more generally cultivated. The long tap-root is sent down into the soil very deeply to search for moisture, and hence it stands hot dry weather very well. It is surprising how it thrives on comparatively poor soil. The seed should be sown this month, and where it has failed in previous sowings more should be sown and cultivated to cover the bare patches.

*Turnips and Swedes.*—These winter crops will be best sown this month where the ground is well cultivated. Moisture must be available, and light frequent showers would provide the most suitable conditions to raise a prolific crop. When it has been removed the ground is left in good order for a maize crop, especially if sheep have been turned in to eat off the unmarketable roots.

*Field Peas and Beans.*—In many parts of the district peas and beans do not do well, but where the soil is rich enough, and sufficient moisture is available this crop pays well as pasture for pigs. The ground so utilised is rendered much more fertile.

*Rape, Kale, Cattle Cabbage, and Kohl Rabi.*—All these crops can be sown this month in small or large areas according to the wants of the farmer. During the prevalence of doubtful dry seasons it is best to be prepared with these rich succulent crops for cattle, sheep, and pigs. The latter are at a price which must repay the pork-raiser handsomely, and such crops as rape almost equal maize in food value.

*Lucerne.*—The value of a patch of lucerne on every farm cannot be too strongly emphasised. There are often available little odd corners and irregular shaped areas on creek banks, &c., which, on account of the difficulties of working are now allowed to go to waste. In such places it would be possible, perhaps, to grow enough lucerne to provide abundance of green stuff and even a little hay for the farm stock. For the purpose of the dairy-farmer, it will be found profitable to lay 10 or 20 acres of the best soil on the farm under this valuable crop. As I pointed out in last month's notes, a clean and well worked seed-bed is indispensable for lucerne. Seeing that the crop when once well established will yield continuous cuttings for seven years or longer, it is well worth while taking extra pains to ensure a fair start. In some districts spring planting is preferred. The advantage of sowing in autumn, however, is that the young plants, which in their early stages are extremly tender, will have the moister conditions of winter and comparatively less contention with weeds to enable them to establish themselves and send their roots deeply down into the moister layers of soil before the heat of summer overtakes them.

*Grasses.*—After showery weather the opportunity might be taken to stir up with the harrow bare patches in the grazing areas and reseed.

## EMERALD RYE AT MILLTHORPE.

MR. W. LENNOT sends the following report concerning the trial at Millthorpe of a plot of Emerald Rye from seed supplied by the Department of Agriculture:—

"I sowed the rye on 6th June on ½ an acre of land. At time of sowing the soil was so dry that germination did not take place until 22nd August, when we got nice steady rain, but not sufficient to thoroughly saturate the ground. The rye came up very thin and I have no doubt that a quantity of the seed perished. It made rapid growth and stooled well—as many as forty and forty-five stems from one grain. From end of August to 24th October, the crop had a hard time. Then it got 94 points of rain, which kept it going until 28th November, when it got good rain and made excellent growth, carrying a heavy flag. Harvesting took place on 30th December, the yield from the 10 lb. of seed received being 8 bushels grain and ½ ton of straw, green and fit for hay.

"I am satisfied this variety cannot be beaten for a fodder rye. I have disposed of all the seed I had to spare to neighbours."

# Farm Notes.

## BATHURST DISTRICT.—April.

R. W. PEACOCK.

*Wheat.*—Generally speaking, April is the best month to sow this cereal, and as much as possible should be put in. By sowing early the plants develop a vigorous root system before the cold weather sets in, which is of great importance if the winter should prove cold and wet. In such winters the root development is much less than when the soil is not soddened by excessive moisture. It is preferable to sow those requiring a lengthy season first, such as the Manitobas and representatives of the Lammas and Tuscan groups. The earlier maturing varieties, such as Steinwedel, Allora Spring, and many of the new crossbreds, could be sown later, although the beginning of April is not too early in this district for any of them. It is wise to sow the poorer portions of the farm earliest in the season, as the richer areas are warmer and the growth much greater throughout the winter months. By sowing early less seed is required per acre than if sown late. Less seed is also required when drilled, than by sowing broadcast. A half bushel of seed drilled is sufficient for the early sowings and 45 lb. for the later. If broadcasted these figures should be increased to 45 and 60 lb. per acre.

*Oats.*—Can be sown freely this month; they are mostly left until the teams can be spared after putting in the wheat, and perhaps this is the better practice. Wherever practicable it would be better to sow earlier than is the usual custom, especially if good grain is required; the late sown oats rarely yield as much grain as the earlier sown ones. The Algerian is one of the earliest, and can be sown later than many of the long season varieties.

*Barleys.*—Should be sown largely for grain and also for green fodder. They yield large quantities of grain, which is valuable for pig feed and other purposes. Malting barley should prove a profitable crop. The skinless, or Nepaul variety, owing to its earliness and hardiness, should prove of exceptional value for green food and also for grain. If for the latter, it can be sown later than the other varieties.

*Rye.*—This crop thrives upon poorer soils than the other cereals, and is valuable for green fodder. For this purpose alone it should receive more attention than it usually does, especially with farmers whose holdings are upon the poorer soils. The variety known as Emerald Rye has done very well at this Farm, producing large quantities of good quality fodder.

*Lucerne.*—This crop has not received the attention it merits. It is mostly grown upon the rich alluvial soils, where it yields very heavy crops. It also produces large quantities of fodder when grown upon the lighter soils, and it is questionable whether any other fodder plant will give a greater return from similar soils, throughout our dry summers, when they have been suitably prepared and put under this crop. It requires clean and thorough cultivation, and no crop responds better to such treatment. Many failures have resulted when such has been neglected. It should be sown largely this month, in order to establish itself before the heat of the following summer.

It is preferable to sow it alone, instead of with another crop, as is sometimes practised. In this district there is rarely sufficient moisture to allow of two crops thriving at the same time upon the same land.

*Rape.*—This excellent fodder plant should be sown largely early in the month. It is especially valuable for ewes and lambs, and is relished by pigs and other stock. It requires a good seed-bed, and care must be exercised not to cover too deeply. It is better drilled in rows about 2 feet 6 inches apart, about 3 to 4 lb. of seed being required per acre. If broadcasted, from 6 to 8 lb. are necessary.

*Field Peas and Tares.*—These are excellent plants in a rotation, to be followed by the cereals, and yield large quantities of valuable fodder, which can be mixed to advantage with the cereals. They should be sown largely during the month for fodder and green manuring purposes; for the latter, they are especially to be recommended for the orchard.

*Linseed* should be sown this month, and should prove a profitable crop for seed, which makes excellent food for stock, and there is a considerable demand for it.

*Clovers.*—Perennial clovers should be sown this month, thus giving them a chance to establish themselves before the drought of the ordinary summers. English red clover, alsike, and cow grass are three of the best.

*Grasses.*—Seeds of many of the native perennial grasses should be sown early in the month, as many require a warm seed-bed, and this can be ensured easier at this time than during the early spring. They also get established before the summer, which ordinarily is both hot and dry. Many of the exotic grasses are better sown this month.

*Sheep's Burnet* should receive attention, as it stands a lot of dry weather, and is a deep rooter, hardy, and suitable for light soils. It makes excellent sheep food.

## RIVERINA DISTRICT.—APRIL.

*Wheat.*—Preparation of land intended for the production of wheaten hay should be completed without delay, as no time should be lost in sowing the varieties of wheat most suitable to the respective districts. Here the heaviest crops and the most palatable and nutritious hay are obtained from white wheats, such as Berthoud, Australian Talavera, White Lammas, and Jade. The sowing of wheat for grain crops should be commenced during this month, and completed by the end of May. The land should be ploughed to a depth of 5 or 6 inches, where the depth of the soil will permit, and pulverised as thoroughly as possible. Seed should at all times be sown with the drill, as thereby a considerable saving of seed is effected, and it is evenly deposited at an uniform depth of 2 or 3 inches, thus ensuring even germination and a much more equal growth of plants than is obtainable from broadcast seed. Drill with the seed for hay about 60 lb. of No. 2 or No. 3 superphosphate per acre, and for grain crops a similar quantity of No. 1 superphosphate or B bone phosphate. Sow seed for hay at the rate of 45 lb., and for grain 30 lb., per acre.

*Barley* should be sown without delay for green fodder, and the sowing for grain production should be completed by the first week in May. For green fodder, sow skinless or Cape, the former giving the earliest and best return where the rainfall is light. For greenstuff, use three-quarter bushel of seed to the acre, with the addition of one-quarter bushel of vetches or tares. For grain, sow 25 lb. to 30 lb. of seed, drilling with the seed about 60 lb. per acre of No. 1 superphosphate. For green feed, drill with the seed about 60 lb. to 80 lb. per acre of No. 1 or No. 3 manure, the latter for preference.

*Lucerne* may be sown where it has a chance of getting a start free from weeds, which at this season are very liable to overrun it if the weather prove moist, otherwise it will be better to leave it till July or August. Land should be deeply broken, and the soil thoroughly pulverised, the surface being made even by rolling. Sow 8 lb. to 10 lb. broadcast, but if drilled, less than half the seed will be enough.

*Peas.*—Sow grey or blue field peas, also varieties for table use. Of the latter, none will be found superior to Yorkshire Hero.

*Vegetables.*—Sow beet, parsnip, carrot, cabbage, and cauliflower. Transplant into well manured and thoroughly prepared land such plants of cabbage and cauliflower as are fit.

## THE BROOD SOW.

WHAT is she worth? What has she produced? These are questions that every hog-raiser should be able to answer. The breeding sow has a mission in the herd that stamps her distinctively as a resourceful animal. All female swine cannot be classed as breeding sows. The breeding sow should acquire this title only after distinguishing herself as a producer. Every breeder of hogs should determine whether the mother stock are adapted to the work of production or not. Some will be found not at all fitted to take a place in the breeding herd, others to a limited extent, and of course are not qualified, while others yet are highly endowed with all the motherly instincts and qualifications which make them successful producers. It is this latter class that should be retained in the herd, and kept to fill the distinguished position of the old breeding sow.—*Exchange.*

# Orchard Notes.

W. J. ALLEN.

## APRIL.

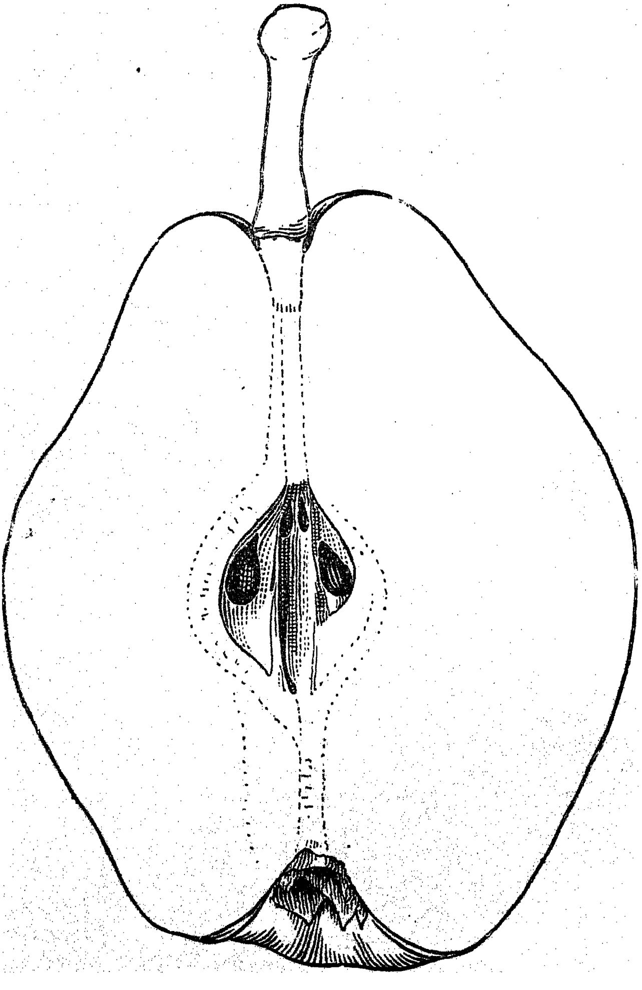
THE trees in many of our citrus orchards, especially the older ones, are showing signs of distress, the leaves being wilted, and many have fallen off; and though much of the fruit is hanging all right, it is not making the growth which it should. As a consequence, a large percentage of the fruit on such trees is undersized, and will, I fear, remain so, even were good soaking rain to fall in the near future. At the time of writing these notes (7th March) a light rain is falling, but I fear not sufficient to do the trees any good, as only a few points have fallen in the Cumberland county in several days.

Some of our fruit-growers whose orchards lie in near proximity to the Nepean River are talking of going in for irrigation, as they claim that there is always a plentiful supply of water there, which, if applied to their orchards, would guarantee them good crops, even during the driest seasons. One gentleman, whose place I visited this week, intends putting down a pump, which will raise at least 20,000 gallons per hour. With such a stream of water he will be independent of drought, and although the plant with the necessary channelling will cost upwards of £400, it will, I consider, be money well spent.

In taking a look through our fruit markets on the 6th instant, I found about 90 per cent. of the locally grown fruit affected with either one or other of our many diseases, the most noticeable on the deciduous fruits being San José scale, codlin moth, fruit fly, and scab, with a little mussel scale; while much of the citrus fruit was scaley. On the other hand, the imported fruit was of good quality, and one cannot help but think that, unless some Fruit Pest Bill is brought into force, it will be only a matter of time before much of our present area planted to fruits will become unprofitable, and in place of raising good fruit in sufficient quantity to supply the requirements of this State, we will be dependent on other States where legislation compels every grower to at least make some reasonable attempt to keep the many diseases in check.

Citrus fruits may still be sprayed with beneficial results wherever scales are prevalent, and fumigation may still be carried on wherever the fruit is not full grown or started to colour; but if fruit is well coloured, the scale, although killed, will, in place of falling off, stick so tightly that it will be found almost impossible to brush it off. Therefore, I could not recommend the latter treatment for fruit which is ripening. There will be very little fruit to handle this month, and the grower will do well to see to any odd work, such as mending roads, fences, drains, repairing cases, and many other odd jobs which have to be neglected, perhaps, during the busy season.

I would again warn growers against the practice of fumigating during very hot or in wet weather. In mixing the water and sulphuric acid, it is best to put the water in first, as the acid is not so liable to spurt where large quantities are being used; for the average small-sized trees it makes but little difference.



Section of Keiffer's Hybrid Pear.

In case the grower intends giving his orchard two ploughings, the first should be completed at as early a date as possible. Outside of this, the land should have as complete a rest as possible until the winter ploughing, when all weeds which may have grown will be turned under while still green, and before they seed. It is now rather late to sow seeds for green crops, as there are very few crops which will make much of a growth between now and August, which month in most instances is quite late enough to do the winter ploughing.

Planting of citrus trees may be continued this month. When autumn planting is practised, care should be taken in handling such trees not to expose the roots to either wind or sun for any time.

Codlin moth bandages must still be kept on the trees, as, even after all the fruit is removed, an occasional grub finds its way to the bandage.

Trees badly disfigured by the ravages of woolly aphis, are a source of danger in the orchard, as are also rough-barked varieties of either apples or pears, as in the ruptures caused by the woolly aphis will be found numerous grubs, as also underneath the rough bark, and it is a question whether it would not pay to cut all trees well back or down, which are in very bad condition, as I feel sure it will be impossible to eradicate the moth while the trees offer such excellent harbour for the grubs. It is very noticeable when removing bandages that those trees which are badly disfigured with woolly aphis are rarely found to have many moths under the bandages, but on a close inspection of the knobs grubs may be found in all of them, and where this is the case, there is but slight hope of ridding the orchards or district of this pest.

All dormant bud ties may be removed this month.

The stones and pits of the different fruits required for stock-raising may be planted this month.

Trees required for refills or for planting new orchards should be secured as early as possible, and all land which is to be planted should be prepared without delay.

In purchasing trees deal with nurserymen who are known to have a good reputation, and who are raising their own trees, as it is to their interest to supply nothing but good stocks, if they hope to do any future business. There is nothing more discouraging than to find after growing trees for three or four years that the varieties are worthless.

Growers in different localities often find that they have a variety which is doing exceptionally well in their particular district. In this case, if they are not sure of the name, and cannot get it properly named, I would recommend that they should send their wood to a nurseryman, and have him work as many trees for them as they require. In this way they are sure to get exactly what they require, and I feel sure there is not a nurseryman but what would undertake to carry out such a contract carefully.

Two or three good varieties are much better than two dozen, and one case of good fruit is generally worth as much as three or four cases of poor fruit; therefore it is well to exercise great care to choose only the best, if it is hoped to make fruit-growing pay.

In reply to the repeated inquiries which reach me from day to day as to the prices of chemicals required for fumigating, I quote the following from the price list supplied me by the Farmers' and Settlers' Co-operative Society (Limited), Fruit Branch, Bathurst-street Markets.

*Cyanide of Potassium.*

| | s. | d. | |
|---|---|---|---|
| 2-cwt. parcels | 0 | 11 | per lb. |
| 1-cwt. ,, | 0 | 11 | ,, |
| 56-lb. ,, | 1 | 0 | ,, |
| 28-lb. ,, | 1 | 1 | ,, |

*Sulphuric Acid*

| | s. | d. | |
|---|---|---|---|
| 120 lb. and over | 0 | 1¼ | per lb. |
| Lesser quantity | 0 | 1½ | ,, |

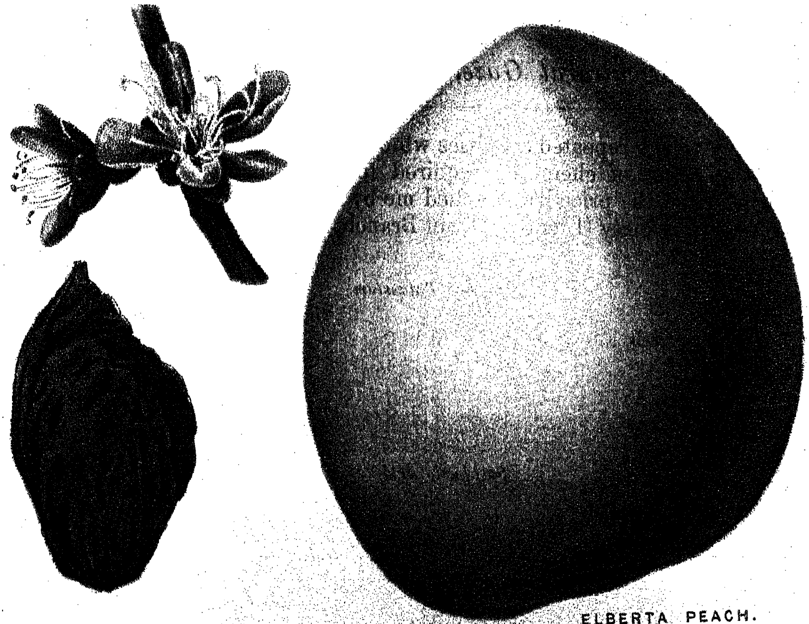
*Tent Sheeting.*

From 8d. per yard upwards in 60-yard pieces.

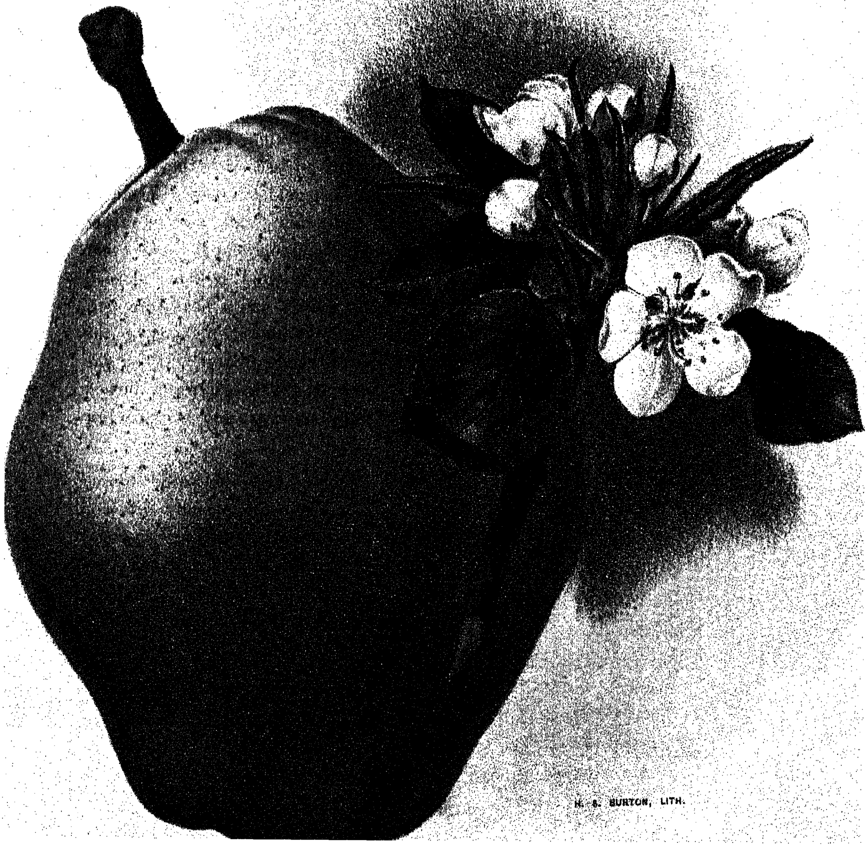
### Reference to Coloured Plate.

*Kieffer's Hybrid Pear* is said to have had its origin in Pennsylvania—raised from seed of the China Pear, and is supposed to have been accidentally crossed with the Bartlett. Fruit medium to large, oval, pyriform; when ripe, a rich golden yellow, sprinkled thickly with small dots, sometimes tinged with red on the sunny side. Flesh rather coarse; when quite ripe, is rather juicy and melting. Flavour somewhat resembles that of the quince. Is used rather largely for canning in America, where it is being planted extensively. Tree very vigorous, with handsome shining foliage, and a heavy cropper. Ripens latter part of March to April. This pear should not be allowed to hang on the tree until coloured, or the core becomes a mass of almost woody matter. If, on the other hand, the fruit is picked when it attains full size, or even a little before and allowed to ripen in bulk in the dark, it will colour up a beautiful yellow, making a fair pear for eating, but excellent for canning.

*Elberta Peach.*—Said to have originated in Georgia, and a cross between Chinese Cling and Early Crawford. Medium to large size, roundish oval, strongly sutured, lemon yellow, blush on sunny side, flesh pale yellow, tender, juicy. Tree very vigorous, prolific, and found doing well in almost any climate. At our Bathurst orchard this year we picked peaches weighing 11½ oz., and at the Hawkesbury Agricultural College orchard we picked them even larger. It is one of the best freestone shipping peaches we have, and is valuable for dessert, canning, or drying.



ELBERTA PEACH.



H. S. BURTON, LITH.

# Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

## DIRECTIONS FOR THE MONTH OF APRIL.

### Vegetables.

AT this time of year the vegetables known as tender vegetables, such as the kidney or French beans, and tomatoes, are practically over, and except about parts of the Tweed, Richmond River, and Clarence River districts, and perhaps some warm places still further south along the coast, there is but little use attempting to grow them; but if anyone should have growing any particularly good varieties of tomatoes, it would be worth while making an endeavour to strike cuttings, and if successful thus saving the varieties, and having plants on hand to plant out very early in the spring, with a better chance of an early crop than could be obtained from seedlings raised in the spring. It may be rather difficult to preserve these rooted cuttings during the winter months, for they may very easily be destroyed by frosts. However, they may be protected at night by boxes, glass frames with coverings over them of straw, of bags, or anything handy that will keep out heavy frosts. As the rooted cuttings may be planted quite close together, it is possible to keep quite a number in a very small space of ground, or in a box, or one or two pots even, which may be taken into an outhouse at night.

Pumpkins should be ripening well by this month, and can be stored for the winter, taking the greatest care not to bruise any when storing. Every farmer, or for that matter anyone else who has a sufficiently large garden, should raise sufficient table pumpkins to last through the winter months. The best variety of seed possible should be obtained, and no other kinds should be sown in the same garden; but as the time for sowing seed is not until the spring, further particulars will be postponed for the present.

*Asparagus.*—As this vegetable should be planted early in the spring, just before the shoots start into growth, some ground should be prepared in good time. This should be trenched 2 feet deep, and a heavy dressing of farmyard manure should be mixed up with the soil when the trenching is proceeding. Some good soils may not need manure unless they are of a heavy, sticky clay nature. Then, no matter how rich they may be, it would be advisable to apply the farmyard manure or a very heavy dressing of lime, say, at the rate of 2 tons to the acre. This will quite alter the character of the soil, and cause it to become friable and easy to work. When the ground is prepared, allow it to remain in a rough condition until the time for planting is at hand, when the surface can be dug and trenches prepared for the asparagus.

*Beans, Broad.*—The month of April is very suitable for the sowing of broad beans. Although heavy soil is the most suitable for this vegetable, it can be grown almost anywhere, and by the application of good manure it should succeed satisfactorily. Before applying the farmyard manure a good dressing of common lime or of gypsum or sulphate of lime will improve not only the growth of the beans but their quality. Sow the seed in rows about 3 to 4 feet apart, an inch and a half or 2 inches deep, and set the seeds about 4 inches apart in the rows.

*Beans, Kidney or French.*—It will only be safe to sow in places where there is not likely to be any frosts.

*Beet, Red and Silver.*—A little seed may be sown with the chance of a crop. Thin out any advancing plants which are growing too close together.

*Borecole or Kale.*—This vegetable, a member of the cabbage family, succeeds best in cool climates, where it is worth growing. It may be treated as ordinary cabbage, and a little seed may be sown during the month.

*Brussels Sprouts.*—This is another sort of cabbage, and an excellent one, too, which should be grown extensively in the cool climates. Like all the members of the cabbage tribe, it will need rich soil, plenty of moisture, and good cultivation during the whole time of its growth. Sow a little seed, and if any plants have been raised, and are suitable, plant them out about 2 feet apart each way, a few at a time, during the month.

*Cabbage.*—Seed may be sown extensively, not all at one time, but occasionally during the month, and plant out any young cabbages which may be on hand; but use abundance of good manure, for the cabbage is a good feeder and needs a considerable amount of nourishment. Sow seed of the red variety for pickling. If all that are planted are not required for pickling they can be made use of as the ordinary cabbage.

*Cauliflower.*—Sow a little seed occasionally during the month in order to keep a sufficiency of plants ready for planting when required. In order to grow the best of either cauliflower or cabbages for planting out, the seedlings should be pricked out a few inches apart, as soon as they are large enough to move from the seed bed. They will then become much more robust and satisfactory than if allowed to remain crowded up in a seed bed. Always endeavour to move any of the plants without breaking their roots. The cauliflower needs very rich soil in order that it may grow to the perfection that it should; and it should have no check during its growth.

*Carrot.*—Sow seed during the month from time to time, making the drills about a foot apart. Sow the seed not more than an inch deep. Avoid the use of fresh manure, and, if possible, use ground that had been well manured for a crop which has been gathered.

*Celery.*—Sow a little seed, and plant out any seedlings which are on hand and are well grown. Earth up plants which have attained almost the full growth. The soil for celery should be made quite rich, and the use of abundance of water is necessary to produce good tender celery.

*Endive.*—Sow a little seed of this useful substitute for lettuce. If seedlings are on hand, plant out a few occasionally during the month.

*Leeks.*—This is a good time to sow seed and raise leeks for planting out in trenches or on the flat, if that system be preferred. When planted in trenches water and liquid manure can be applied more easily than when they are planted on an ordinary bed. The use of abundance of water and of liquid manure is advisable during their growth.

*Lettuce.*—Sow seed from time to time in order to keep up a sufficient stock of plants. This is a good time to plant and sow lettuce seed, and the seedlings may be transplanted, without much chance of the plants running to seed as they are likely to do during the summer months.

*Onion.*—Sow freely of onion seed during the month, for April, if the soil is in favourable condition, is a good time for sowing extensively. Use a good deal of rich farmyard manure, dig the soil well, drain well, and make the surface as fine and even as possible. Sow in drills about 1 foot apart, and cover the seed but lightly with fine soil. When the plants come up, it will be necessary to hand weed them, and particular care should be taken to keep them free from weeds. If small pickling onions are required sow some seed very thickly broadcast.

*Parsley.*—Sow a little seed.

*Parsnip.*—Sow a little seed occasionally. The soil should be trenched for this vegetable, as its roots descend deep into the ground. It is better not to apply manure, but to use land that has been well manured for some other vegetable.

*Peas.*—If sown now a good return may be expected if occasional showers of rain fall during the growth of the plants. Sow in drills from 3 to 5 or 6 feet apart, according to height of variety. The dwarf kinds may be sown closer together than this. Use plenty of farmyard manure, and if lime can be obtained easily apply a dressing on the surface of the soil, and if raked in lightly it will gradually sink into the soil quite deep enough.

*Radish.*—Sow a little seed in drills from time to time during the month, and make use of the radishes before they grow large.

*Sea-kale.*—Preparations can be made for planting roots of this somewhat uncommon vegetable, the only difficulty with which is the blanching of its young shoots in the spring. The botanical name of the plant is *Crambe maritima.* It is a distant relative of the cabbage, but belongs to a different genus. From very ancient times it was collected about the sea coast in Great Britain and Europe, and the large bluish-green coloured leaves were boiled and used as cabbage is used; but in its native state it is coarse and by no means very palatable. Within comparatively recent times it was found to be a most delicious vegetable when its young leaves were blanched, and at the present day is used to a considerable extent in England, but not so much as it deserves to be in other countries. The old writer on botanical subjects—Gerard—refers to this plant in his *Herbal* thus:—"The sea colewort groweth naturally upon the bayche and brimmes of the sea, where there is no earth to be seene, but sand and rowling pebble stones." This vegetable is supposed to be the *Halmyridia* referred to by Pliny, who says it grows only on the sea-coast, and that provision is made of them to serve in long voyages at sea, for as soon as they are cut up they are put into barrels where oil has lately been kept, and then stopped up close that no air can come to them. As this plant is a perennial, like asparagus or rhubarb, the ground in which it is to be planted should be trenched, well manured, and carefully drained. Either seedling plants, roots, or portions of roots may be planted in rows about 4 feet apart, the plants to stand about 18 inches or 2 feet apart in the rows. As much growth as possible of large leaves should be encouraged after the plants start into growth, whereby the buds which form in the axils of the leaves may be induced to grow large, for from these buds the leaves will come next season. When the leaves drop off in the winter, light soil may be heaped up for a foot or 18 inches over the crown of each plant; or, in the spring, large pots (some are manufactured especially for the purpose) may be placed over the crowns. As the object is to blanch the young shoots as they grow, any sort of light material may be used with a little ingenuity to effect the object. The use of light sandy soil is perhaps the easiest, but much care must be taken in removing it from the tender and very brittle shoots when they are ready for cutting. After a trial or two with sea-kale anyone accustomed to gardening should be able to grow good sea-kale and blanch it satisfactorily. A failure or two should not dishearten a beginner.

*Spinach.*—Manure some ground well, and sow a little seed occasionally during the month.

*Shallots.*—Plant a few bulbs about 1 foot apart each way.

*Herbs.*—Sow seed of any kinds that may be required, or plant if any young herbs have been raised from seed.

## Flowers.

THIS is about the best time of year to start making a flower garden—the best time to strike cuttings of the ripened wood of roses, of pelargoniums, of carnations, verbenas, and indeed of almost all sorts of garden plants; but the cuttings will need to be looked after, for it is not likely that if they are first stuck in the ground, and left to chance, that they or any of them will grow, although, strange to say, it sometimes happens that cuttings put in anyhow, and allowed to shift for themselves, sometimes succeed wonderfully well. Some persons are born gardeners, and seem able to play remarkable pranks with plants and seeds and cuttings, and succeed in growing plants under conditions where others seem bound to fail, even though every care be taken.

April is one of the most important months in the year for those who are already provided with flower gardens or for those who intend to create them. Alterations may be made where necessary; seeds of all sorts of hardy annuals and also of perennials may be sown either in the open garden or else in pots. or boxes, whence the seedlings may be transplanted as soon as they are ready. Hybrid perpetual roses may be pruned; grass may be laid down; walks made or remade; and, in point of fact, any kind of work may be carried out except the planting or transplanting of deciduous trees, shrubs, or small plants; but the garden may be made ready for them, and planting can be carried out towards the end of May and for the two following months. Bulbs may still be planted if this work should have been overlooked.

## A NEW TOMATO—HOLMES' SUPREME.

THIS is a capital tomato, and, in my opinion, after having made a trial with it under adverse conditions, is well worth a trial by anyone who grows tomatoes for his own use. Whether it would be worth growing for market I can hardly say, considering the requirements for market here are, I imagine, judging from observations, tomatoes of a large size. Quality, for market, for tomatoes, strawberries, and other fruits, and for vegetables also, seems to be a matter of indifference, the main object being, apparently, that of size, and if highly coloured all the better. Now, this is where the grower of his own tomatoes and strawberries, as well as of vegetables and fruits, has "the pull" of the market gardener. He can grow just what pleases his own fancy and palate. He need not trouble himself about size, or colour, or fashion. If he prefers small tomatoes, sweet luscious strawberries, good old kinds of peas (many of which are infinitely superior to some of the modern kinds), or fruits, which cannot be purchased for all the gold he could offer, he can grow them if he chooses to take the trouble, provided he has acquired sufficient practice. As I am only writing for the guidance of those who grow their own vegetables, I can highly recommend the above tomato.

Just as I happened to be in the full swing of growing my plants I was obliged to leave them pretty well to themselves, and, as most of them were in pots, my experiment was not so successful as it would probably have been had I attended to it myself. My chief object in growing the tomatoes in pots was to ascertain by experiment in how small a pot I could grow and fruit tomatoes—that is, to limit the root area to the smallest dimensions. I may say I have been remarkably successful in growing several genera of plants to surprising dimensions in quite small pots, and, if my time at home was not so intermittent as happens to be the case, I should carry on many experiments which might prove not only of great interest but of value.

The tomatoes in question produced good fruit, quite sufficient to enable me to judge of quality and appearance. The fruit is very pretty, beautifully smooth, of a rich dark red colour, and of excellent quality, infinitely superior, to my taste, to such tomatoes as Mikado and other huge varieties. In small pots having a diameter of 3 inches only the plants attained a height of 2 feet 6 inches, and produced each several good-sized tomatoes. Had I been able to give the plants proper attention, I believe the results I should have attained would have been surprising.

The seed of this tomato I obtained in Melbourne last year when it was sent out as a novelty.

My opinion with respect to this tomato has been confirmed by a writer in the English magazine named *The Garden*, published 24th January, 1903. This writer says: "All who have grown this very fine tomato must agree that the three marks awarded by the Royal Horticultural Society were never better bestowed, for, after trial with the best varieties in cultivation last season, it came out with flying colours, and must, indeed, become a prime favourite either for market or private growers. For pot culture it is admirable, the growth being very stout, whilst the heavy, short-pointed bunches of fruit—as many as eight or nine to the bunch—are as freely produced as anyone could wish. Not over large, they are just the right size, and of so perfect a shape as to find a ready sale." Perhaps, considering this opinion, the tomato, Holmes' Supreme, might be worth a trial for market as well as for private gardens.

In case anyone should be led to make trials in the growing of large plants in little pots, I should advise them not to make the attempt unless they can give constant attention to the plants during their growth. They will need watering at least two or three times a day, for but little water at a time can be supplied owing to the roots quite filling up the pots in a very short time. It has often surprised me that the roots do not burst the pots when the plants are in full growth. Some strong-growing plants, such as the Aspidistras, do frequently burst their pots, and yet I have grown genera of hard-wooded plants —quite large ones too—for years in the same small pots.

SINCE the above was in type, I received the following memorandum from Mr. F. C. King, Labour Master of the Labour Farm, near Little Bay. Mr. King is a professional gardener, and an excellent observer, and I can rely with confidence on his trials of vegetables. I sent him a few seeds of Holmes' Supreme at the time I sowed my own. He reports:—"I sowed the seed on 6th August, and transplanted the seedlings on 27th August. The plants were allowed to grow to the height of 6 inches. They were very robust, and free from all disease. I planted them out in the open ground on 21st September, and they all grew splendidly, making fine healthy shoots, which required considerable thinning. Holmes' Supreme is one of the best all-round tomatoes that could be grown for the private garden or for market purposes, producing flowers from every joint and setting freely, mostly five nice medium-sized fruits, smooth and round, solid, and of excellent flavour. The fruit ripened 4th December."

—W. S. CAMPBELL.

# General Notes.

## HARVESTING BROOM CORN.

THE chief difficulty encountered by the novice in broom corn culture is in determining when to harvest the brush. Even experienced growers are not unanimous on this point, some cutting the heads while in blossom, and others harvesting later so as to obtain better developed seeds possessing considerable nutritive value. In a special bulletin on Broom Corn, issued by the United States of America Department of Agriculture, it is stated that the time generally preferred is just after the fall of the so-called blossom (anthers.) When the saving of more mature seed is a consideration the head may be bent down by sharply bending the stalk at a point 12 to 18 inches below the base of the head. Thus the seeds while filling hang down, and tend to keep the brush straight. This lopping, if practical at all, is done after the head has attained its full length, but before the seeds acquire much weight. It is not practised by large growers.

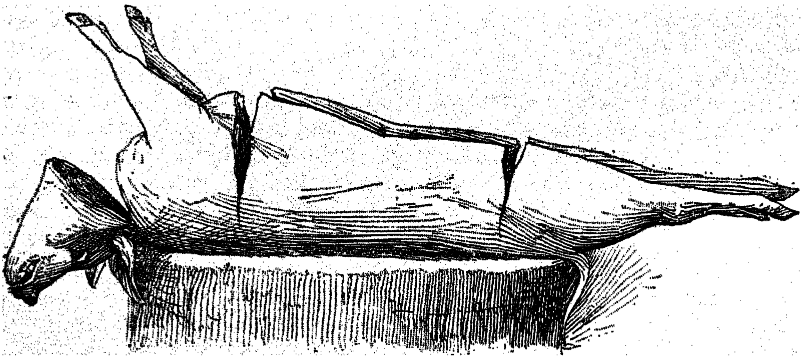
A common custom with tall varieties at time of harvesting is to bend down the stalks of two rows diagonally towards each other in such manner that the bent part support each other in a nearly horizontal position. The stalks of one row cross diagonally those of the other, and form a platform or table. The break, or rather the sharp bend, in the stalk is made about 2½ to 3 feet above the ground. The brush borne on one row projects over and beyond the other row in a position convenient for the cutter who follows immediately. The heads, with 5 inches of stalk, are laid on the table or platform, until they can be removed to a drying shed. Cutting while the plants are wet with dew or rain should be avoided. The brush of the dwarf variety is pulled, not cut. If the season is dry as the corn approaches maturity the brush remains straight, but if the weather is hot and damp at this period the straws are likely to bend and to form crooked brush. In harvesting and in curing great pains are taken to keep the brush straight. Crooked or tangled brush is carefully sorted out.

From the field the brush is taken to the scrapers, which remove the seed. Large growers of broom corn employ special scraping machines, consisting of one or two cylinders provided with iron teeth, and usually driven by horse-power. The most complete scrapers are provided with an automatic feeding arrangement. With cheaper machines the operator holds the seed end of a handful of brush against the cylinders until the seeds are removed. It is stated that the ordinary thrashing machine, with concave removed, has been used in a similar manner. For small quantities of brush, a long-toothed currycomb or a wooden comb, made by sawing teeth in a plank, has been used.

The brush should be cured in the shade, as exposure to sun or moisture injures its colour and strength. Free circulation of air is necessary in this process. Hence when large quantities are to be cured special curing-houses, thoroughly ventilated and provided with racks, made of narrow planks and laths, are constructed. On these racks layers of brush 3 inches thick are laid. Curing is continued until the brush will not heat when bulked or baled. When cured the brush is pressed into bales, usually 46 by 30 by 24 inches, and weighing about 300 pounds. The butts are placed evenly at the ends of the bale, and the pieces of brush lap in the middle. The labour of harvesting and curing makes it considerably more expensive to grow an acre of broom corn than a similar area of maize. Greater skill is also required in handling the former crop.

## PREPARING PORK AND BACON FOR HOME USE.

IT is necessary to give the greatest care to the preparation of the pig and to the curing of the product, in order to secure a uniformly good article of food. Before slaughtering, the pig should be in perfect health and in that condition of flesh that will make a good quality of meat when dressed. An animal to furnish good meat should be gaining right up to the time of slaughtering. The care just previous to slaughtering is quite important. It is not a good plan to kill an animal while on full feed. It should be off feed at least twenty-four to thirty-six hours, but should have all the water it will drink. The slaughtering should be quickly and neatly done, and the dressing should also be neatly done, care being used to remove all scurf and hair, if possible. The temperature of the scalding water should be 180 to 185 degrees. This will insure a scald that will allow the hair being pulled out by the roots, which is very much preferable to shaving it off and leaving the hair roots and a portion of the bristles in the skin.



The accompanying illustration shows a convenient method of cutting, and one which is well adapted to farm use. It will be noted that three cross sections of the hog are made: one removing the head, the next the shoulders between the fourth and fifth ribs, and the next removing the hams about 2 in. to 3 in. in front of the pelvic bones, which brings the cut just to the top of the ham. This divides the hog up so that it may be easily sawed through with a short meat saw. The hams require very little trimming to put them into presentable shape for the pork barrel, and the shoulders can also be trimmed easily by simply removing the ribs and neck piece, and trimming off the rough meat for sausage and lard. The middle is then split through the centre. The lower two-thirds of the side is removed, cutting through the ribs with the saw. The ribs are afterwards removed from this piece just as closely as possible, leaving all the lean meat on the side. Then the piece is trimmed a little along the lower line, and a part of the flabby flank meat removed for lard. That portion of the pig that is best adapted to a good quality of bacon is thus secured for curing.

Of the upper third of the back, the lean muscle, including the ribs, is removed in one piece and makes what is called the pork loin. From this, chops or pork roasts are cut. The fat coming from this back strip is commonly put in with the lard and other fat trimmings and tried out. All lean trimmings, of course, are made into sausage. The head and feet are cleaned up and used for head cheese, or pickled.

A great deal of the value of the product depends upon proper curing. Meat should never be salted until all of the animal heat is out, but as soon as the heat is out the quicker it is salted the better. On the other hand, meat should never be allowed to become stale, with an idea that salt will cure the staleness. It may cover it up, but it can never remove it. In salting down, especially during the cool weather and for winter use, it is advisable to use some sugar with the salt and saltpetre, in order to give it a milder, sweeter cure. A good recipe is as follows: 8 lbs. common coarse salt; 2 lbs. brown sugar, or 1 quart of molasses; 2 ozs. saltpetre, and 4 gals. water to each 100 lbs. meat. In warm weather 2 lbs. more salt, and 2 ozs. more saltpetre should be used. The meat should be packed closely in a clean barrel (hardwood preferred), or in a stone jar large enough to hold the required amount. The salt, saltpetre, and sugar are dissolved in the water and then turned over the meat.

If there is not sufficient of the brine to cover the meat, more brine of the same strength is added as any portion of the meat uncovered is likely to rust and spoil, and in a short time the brine in the whole barrel would be spoiled. A cover and weight should be placed on the meat to keep it below the brine. In warm weather it is advisable to boil the brine and allow it to cool before putting it over the meat. The sugar, if used in larger quantities, is likely to make a "ropey" brine and one which will not keep so long as one without sugar, but, if the pork is cured in the winter for summer use, this will give the meat a good flavour, and it will not be so tough and hard as when cured in clear salt. The brine has not strength enough to overcure the meat, but still it has sufficient to keep it for almost any length of time. Six to eight weeks in brine of this strength will cure bacon and hams weighing 12 to 14 lbs. While it may remain in the brine much longer than that, the best quality of meat will be obtained if removed from the brine as soon as cured through. Smoke and pack away for summer keeping.—*American Agriculturist.*

## AGRICULTURAL SOCIETIES' SHOWS, 1903.

| Society. | Secretary. | Date. |
|---|---|---|
| Bega Agricultural, Pastoral, and Horticultural Society. | J. Underhill | Mar. 4, 5 |
| Braidwood P. and A. Society | G. F. Taylor | ,, 4, 5 |
| Liverpool A., H., and I. Society | J. E. Wilson | ,, 4, 5 |
| Tenterfield Intercolonial P. A. and M. Society | E. W. Hoskin | ,, 3, 4, 5 |
| Tenterfield Fair Days | ........... | ,, 6, 7 |
| Berrima District A., H., and I. Society | J. Yeo | ,, 5, 6, 7 |
| Bombala Exhibition Society | R. M. Cook | ,, 10, 11 |
| Campbelltown A., H., and I. Society | A. R. Payten | ,, 10, 11 |
| Central New England P. and A. Assoc. (Glen Innes) | Geo. A. Priest | ,, 10, 11, 12 |
| Quirindi District P., A., and H. Society | Geo. Naughton | ,, 11, 12 |
| Tumbarumba and Upper Murray P. and A. Society | J. J. McAlister | ,, 11, 12 |
| Port Macquarie and Hastings District A. and H. Society | J. Y. Butler | ,, 12, 13 |
| Nepean District A., H., and I. Society | E. K. Waldron | ,, 12, 13 |
| Goulburn A., P., and H. Society | J. J. Roberts | ,, 12, 13, 14 |
| Gundagai P., A.. H., and I. Association | A. Elworthy | ,, 18, 19 |
| Blayney A. and P. Association | H. R. Woolley | ,, 18, 19 |
| Castle Hill and District A. and H. Association | R. H. Lalor | ,, 18, 19 |
| Inverell P. and A. Society | T. P. Borthwick | ,, 18, 19, 20 |
| Armidale and New England P., A., and H. Association (Armidale) | W. H. Allingham | ,, 18, 19, 20 |
| Camden A., H., and I. Society | C. A. Thompson | ,, 18, 19, 20 |
| Crookwell A., P., and H. Society | C. T. Clifton | ,, 19, 20 |
| Newcastle and District A., H., and I. Association | M. A. Fraser | ,, 19, 20, 21 |
| Castle Hill and District A. and H. Association | R. H. Lalor | ,, 20, 21 |
| Liverpool Plains (Tamworth) A. and H. Association | J. R. Wood | ,, 24, 25 |
| Gulgong A. and P. Association | G. E. Hilton | ,, 25, 26 |
| Orange A. and P. Association | W. Tanner | ,, 25, 26, 27 |
| Macleay A., H., and I. Association | E. Weeks | ,, 25, 26, 27 |
| Walcha P. and A. Association | S. Hargrave | ,, 31, April 1 |
| Cooma Pastoral and Agricultural Association | C. J. Walmsley | April 1, 2 |
| Mudgee Agricultural Society | Joseph M. Cox | ,, 1, 2, 3 |
| Upper Hunter (Muswellbrook) P. and A. Association | P. Healy | ,, 1, 2, 3 |
| Royal Agricultural Society of N.S.W. (Sydney) | F. Webster | ,, 8 to 16 |
| Hunter River (West Maitland) A. and H. Association | W. C. Quinton | ,, 21 to 24 |
| Bathurst A., H., and P. Society | W. G. Thompson | ,, 22, 23, 24 |
| Dungog A. and H. Association | Chas. E. Grant | ,, 29, 30 |
| Wellington P., A., and H. Association | A. O. Rotton | ,, 29, 30 |
| Richmond River (Casino) A., H., and P. Society | E. J. Robinson | ,, 29, 30,<br>May 1 |
| Wellington P., A., and H. Association | A. E. Rotton | ,, 29, 30<br>May 1 |
| Upper Manning (Wingham) A. and H. Association | W. Dimond | May 6, 7 |
| Clarence P. and A. Society | Jas. C. Wilcox | ,, 6, 7 |
| Hawkesbury District Agricultural Association | C. S. Guest | ,, 7, 8, 9 |
| Lower Clarence Agricultural Society (Maclean) | Geo. Davis | ,, 12, 13 |
| Nyngan and District P. and A. Association | R. E. Burns | ,, 19, 20 |
| Cobar P. and A. Association | J. M. Scott | June |
| Riverina P. and A. Society (Jerilderie) | W. Elliott | July 28, 29 |
| Hay P. and A. Association | G. S. Camden | ,, 29, 30 |
| Narrandera P. and A. Association | J. F. Willans | August 5, 6 |
| Parkes P., A., and H. Association | G. W. Seaborn | ,, 12, 13 |
| Grenfell P., A., and H. Association | Geo. Cousins | Sept. 2, 3 |
| Northern Agricultural Association (Singleton) | C. Poppenhagen | ,, 2, 3, 4 |
| Albury and Border P., A., and H. Society | Walter J. Johnson | ,, 9, 10 |
| Yass P. and A. Association | W. Thomson | ,, 10, 11 |
| Cootamundra A., P., H., and I. Association | T. Williams | ,, 16, 17 |
| Temora P., A., H., and I. Association | W. H. Tubman | ,, 29, 30 |

[4 plates.]

VOL. XIV. PART 5. MAY, 1903.

*Agricultural Gazette of New South Wales.*

## REPORT ON MR. N. A. GATENBY'S EXPERIMENT.

BY A. A. DUNNICLIFFE,
Inspector of Agriculture.

THE day has gone by for disputation concerning the utility of irrigation in a land such as ours, where the seasons are so uncertain and irregular, and where the flow of the rivers is subject to such extreme fluctuations. In every part of the world where cultivation of the soil has made any advancement the benefits of irrigation are acknowledged; and to a greater or lesser degree artificial means are adopted to make the land bring forth its fruits more abundantly. In this State particularly, for the reasons above indicated, the wisdom of irrigation is forcing itself upon the mind of every person who has to do with the land, and, although there has been comparatively little development in this direction in New South Wales, not a few experiments have been made during recent years, both by Government and private individuals, to demonstrate the immense advantages to be gained by its application to lands set apart for grazing or agricultural purposes. In those places where irrigation farms have been established in connection with artesian bores (notably at Pera and Moree), most satisfactory results have been obtained, ample proof having been furnished that the artesian flow can be made to serve the best purpose in the production of remunerative crops on land which would be unproductive if left to the unaided operations of nature. Other experiments in irrigation have been made in some of the outlying districts by private landowners, who have utilised the river waters which would otherwise have run to waste, and in these cases, also, success has attended upon well-directed effort. Chief amongst these enterprising gentlemen is Mr. N. A. Gatenby, of Jemalong, near Forbes, whose efforts in this direction have been attended with most marvellous results; and the purpose of the present paper is to set out the details of a practica demonstration conducted on that gentleman's station during the latter part of last year and the beginning of this, with the view of illustrating how stock feeding can be profitably carried out under the most adverse natural conditions, and how the disastrous effects of our Australian droughts can be minimised.

The circumstances in which this interesting experiment originated may be briefly stated as follows:—At a meeting held during the annual show of the Forbes Pastoral and Agricultural Association in August last, Mr. Gatenby, whose enthusiasm and forward movements in the direction of irrigation during the past ten years were widely known and much appreciated, was invited, amongst others, to speak. He naturally alluded to the terrible drought and its devastations within the Forbes district and the State generally, and then proceeded to speak of the value of irrigation. He urged that every station should have its irrigated patch, of greater or lesser extent, and declared that with even 200 acres of lucerne sheep owners could save their studs and the best of their flocks, to the number of quite 15,000, through the driest summer months, and that in fact he had done it. The Minister for Agriculture (the Hon. J. Kidd) was present at the function, and being struck by the force of the assertion, he made a note of it, although some of those present openly derided the statement. Subsequently, Mr. Kidd asked Mr. Gatenby if he really intended what he said, and that gentleman replied that he would prove it at once, by sustaining without deterioration, for a period of four months at least, seventy-five sheep for each acre of lucerne, and invited the Minister to send a representative to Jemalong Station to witness the test.

Mr. Kidd recognised at once that such a practical demonstration in sheep feeding would be of exceptional value to pastoralists and others, and shortly after his return to Sydney made arrangements for an officer of the Department to visit the station, and supervise the procedure from start to finish. The officer deputed to that task was the writer, who had himself, when managing the Government Experimental Farm at Bathurst, made extensive experiments in irrigation with river water, his efforts being chiefly directed to the profitable feeding of sheep and lambs on the farm with the fodder grown. At the time of the visit (October) the whole of the district, in common with the greater portion of the State, was in the grip of one of the severest droughts that Australia has known. The whole country surrounding was bare of feed—no grass (not the semblance of a blade), no shrub, not even a weed, but bare baked soil or dust that rose in blinding clouds with every gust of wind. In very truth it was the "abomination of desolation." The reader may imagine the relief that came to eye and mind of the traveller upon suddenly beholding an oasis in this desert, for that term may with perfect fitness be applied to the 400 acres on the Jemalong Station, which Mr. Gatenby had transformed by the magic of irrigation into an area of luxuriant verdure.

Jemalong Station is situated on the Lachlan River, about 20 miles below Forbes, and comprises an area of 44,000 acres, upon which, in normal seasons, from 30,000 to 35,000 sheep, and a proportionate number of large stock, are depastured. There is a comfortable homestead, nestling in a well kept garden, the foliage of the trees and shrubs almost hiding from view the dwelling, which is half a mile from the public road, and is approached by an avenue of well grown ornamental trees. On either side of this avenue there are paddocks of rich herbage, upon which choice stock of all kinds are grazed, and the appearance of these prepares the visitor for the richer treat in the paddocks beyond.

Shortly after my arrival, I was taken by Mr. Gatenby through his run—for 25 miles through what were called "fattening paddocks"—that I might have an opportunity of really seeing the country when left in its natural condition, and then contrast with that within the irrigated area. On one hand barrenness and desolation, wide spread and absolute, met the eye; on the other luxuriant growth of herbage, anything superior to which none could expect or hope to see. The original fattening paddocks on the run, adjoining the irrigated area, and which easily carried a sheep to the acre in ordinary seasons, were now as bare of grass as a macadamised road, the whole surface not showing sufficient herbage to furnish satisfactory feed for a single sheep, not even sufficient in fact to sustain the grasshoppers; and these barren stretches were simply typical of the country throughout the west. Only by actual observation could the mind fully realise the marvellous change which the judicious application of water had wrought upon the portion subject to treatment, and which was now covered with splendid crops of lucerne 3 feet, 3 ft. 6 in., and 4 feet in height, and heavy crops of wheat and oats 4 and 5 feet high. It was just the difference between stagnation and vigorous activity, loss and gain, sickness and health, death and life. While the flocks and herds on other stations had all, without exception, been decimated, some of them to the point of extinction, so that fully two-thirds of the stock in the district had perished by starvation, despite the strenuous efforts of the owners—involving the expenditure of much labour and many thousands of pounds—to keep them alive until rain fell and caused the grass to grow, Mr. Gatenby's losses have been scarcely worth mentioning, and all through determined effort and judicious expenditure in what common sense, the teachings of science, and the experience of graziers and farmers in other places indicated was the right direction. How this end has been achieved it is my privilege and duty to describe.

## A.—Irrigation.

The first step towards irrigation, and, indeed, to provide for the ordinary requirements of station life, is securing an adequate supply of water, and although Jemalong Station has a frontage of about 5 miles to the Lachlan River, that river is not always running; therefore, with these objects in view, Mr. Gatenby has thrown across the river, about half a mile from the homestead, a serviceable weir or dam, simple in structure and inexpensive in cost (see Fig. 1). The foundations are laid with stone 2 feet below the bed of the river, and carried up 6 feet above. This is backed with heavy planking and a body of clay 10 feet wide, the face and return sides being all stonework. On the top it is 75 feet long by 10 feet wide, and throws back the water the whole length of the run. The stone had to be carted a long distance, but the total cost did not exceed £160.

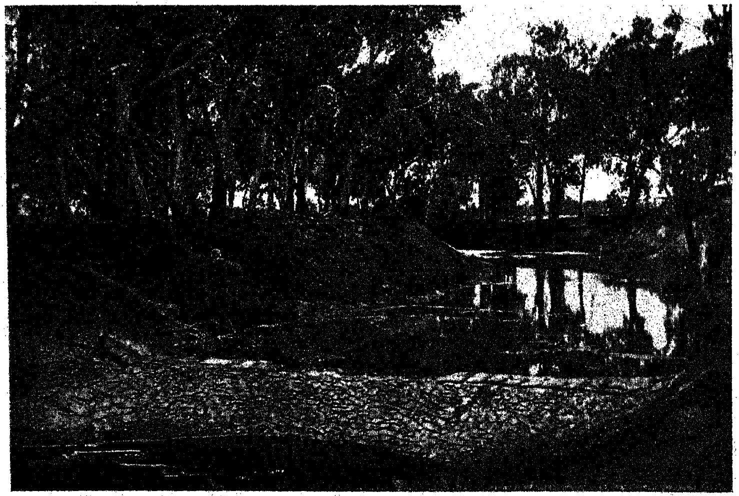


**Fig. 1.—Weir across Lachlan River, Jemalong Station.**

The pumping-station is erected on the river bank just above the weir, and is furnished with a 25-h.p. engine, twin boilers of 40-h.p., by Gwynne, and a 15-inch centrifugal pump by the same maker. The latter does an average lift and force of 20 feet, and is placed about one-third below the level. When supplying the higher levels the water has to be forced 3 feet higher. The capacity of this pump is 3,500 gallons, but under usual working conditions it discharges 2,500 gallons of water per minute into the main water channel (see Fig. 2), from whence it is diverted by other mains to such paddocks as

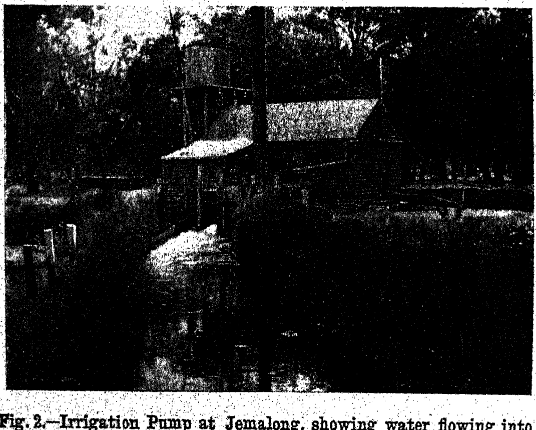


**Fig. 2.—Irrigation Pump at Jemalong, showing water flowing into main channel.**

may require it, the different flows being regulated by simple wooden doors, such as Fig. 3, which are raised or lowered as desired. One of these channels is shown in Fig. 4, and it will be seen that the water is carried considerably higher than the paddocks (on the right hand) to be watered. It will also be observed that the main channel in Fig. 4 has to be carried so high, on account of the low level of the lands which it supplies and passes, that in this case a subsidiary drain has been made alongside to break the fall of the water.

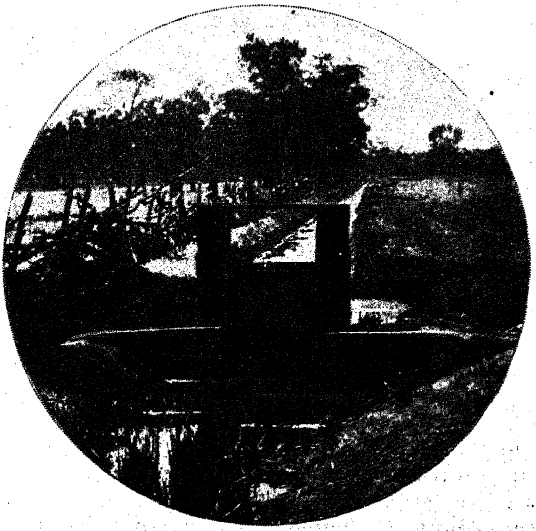


Fig. 3.—Water-gate.

The mode of constructing these channels is by means of the plough and "delver." The latter is a simple appliance consisting of a piece of 8 x 8 hardwood, about 25 feet long, to which is attached, near the head or draught end, a wing, or plain board, about 5 or 6 feet long, placed at an angle of (say) 40 degrees or 45 degrees, with a fin of iron or steel on lower side to steady it. The plough is first put into the land along the proposed line of channel, taking a strip 8 or 10 feet wide, according to the size of the channel required. The delver is then sent up the middle of

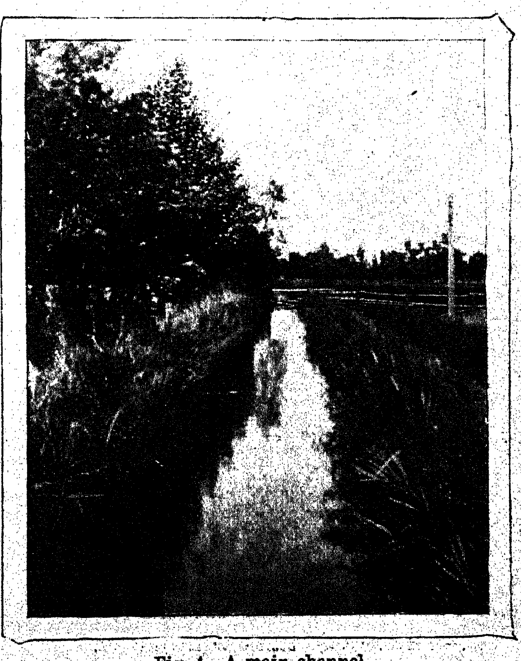


Fig. 4.—A main channel.

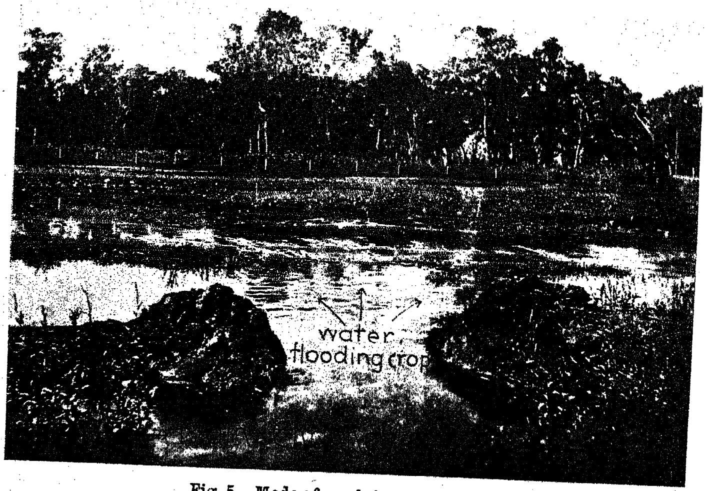


Fig. 5.—Mode of applying the water.

the ploughed land, and throws one-half the loosened soil to the right, and returning, still in the centre, forces the remainder to the left. A further depth is then ploughed, and delved in the same manner, until the channel is completed, as shown in Fig. 6, which is ready to receive the water. Plates showing all detail of construction, with plough, delver, and horses at work, were, unfortunately, damaged in transit from the station, and, therefore, cannot be inserted. At Jemalong the main channels are usually made 10 to 12 feet wide at top, with a width at the bottom of 2 or 3 feet, and a depth of 15 or 18 inches below the surface of the lands, but the earth ploughed out and banked upon the sides gives the channels a far greater carrying capacity. I understand the average cost of making the water channels is 1s. per chain, where there is a fair run in length.

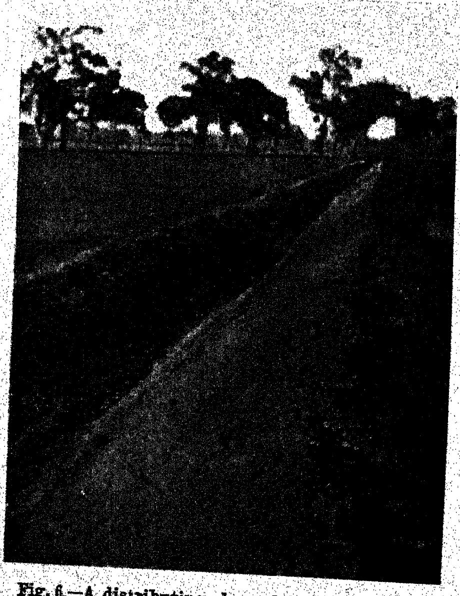


Fig. 6.—A distributing channel as ploughed out.

The system of irrigation adopted at Jemalong being that of surface flooding, the water is brought by channel along one side or end of the paddock, which is divided into lands by "check banks," or slightly raised banks of earth, running generally at right angles to the channel, to confine the water to a definite area, that it may be distributed effectively and quickly. When that land is done, the water is let into another, and so on until the paddock is finished. If the supply of water is sufficient it may be put into two lands or more at once. A drain at the lower side or end takes off the surplus water, which is then applied elsewhere. The width of the lands is a matter of judgment or convenience; at Jemalong they are generally two or three chains wide. The mode of letting out the water is simple in the extreme, namely, by making an opening in the side of the channel with a spade, closing it again with the same. Two or three outlets may be made to a land. Fig. 5 shows the water being thus put on a very young rape crop.

It may be objected that this system of irrigation is wasteful of water, and that more advanced methods must be adopted in the future, as the value of water becomes better recognised. All this is admitted, but it is contended that under the circumstances existing at Jemalong, where the application of water was desired speedily, and with as little outlay as possible consistent with efficiency, Mr. Gatenby was quite justified in his methods.

## B.—The Lucerne Paddock.

On 24th October Mr. Gatenby handed over to me for the purpose of the test a paddock which I measured and found to contain 22½ acres of growing lucerne. This was to sustain, therefore, 1,687 sheep at the rate of 75 per acre. Although there was a good crop of lucerne on the ground, it was evident from its irregular growth that it had not

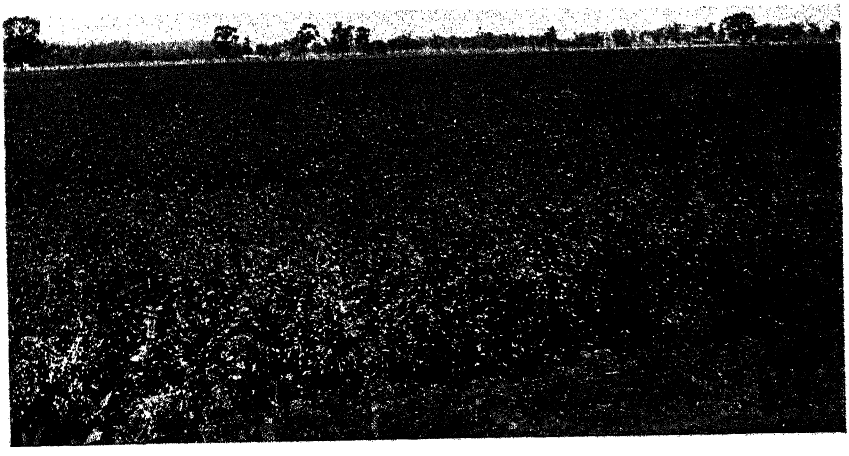


Fig. 7—Lucerne crop 35 days after commencement of experiment.

received any special attention to prepare it for my work. On inquiry, I found it had been shut up for about three weeks, previous to which it had depastured horses and cattle until 15th August, then 550 stud ewes to middle of September, and 80 stud rams to 1st October, when a portion was cut and carted out to the general flock sheep, and the paddock shut up to grow for hay. As I anticipated that the plant after having been cut would require about thirty-five days to arrive again at the same stage of perfection, it was necessary the paddock should last through thirty-five successive daily cuttings of feed, and to provide for these successive growths, I deemed it advisable to cut and remove about

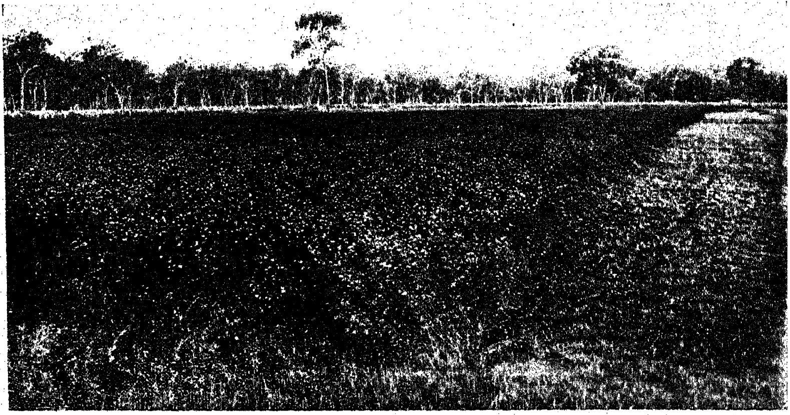


Fig. 8.—Second crop.

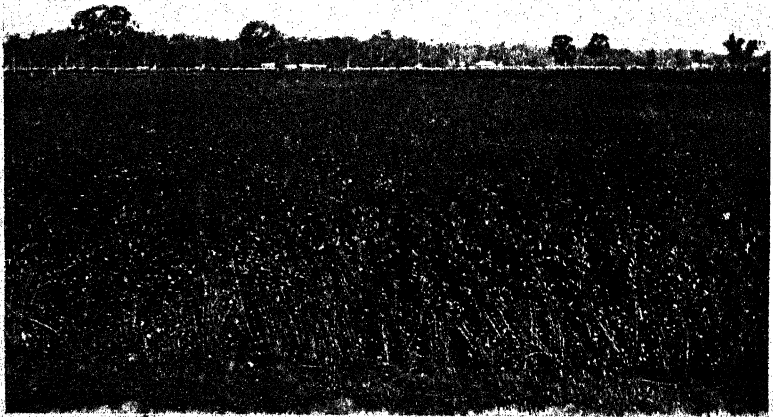


Fig. 9.—Third crop.

ten acres of the crop, converting it into hay. The paddock had, for purposes of irrigation, been divided into seven lands, and we found this division very convenient in our work. These lands were cut in succession, and by the time the seventh, or last, was finished, the first was always ready again. To illustrate this, Fig. 7 shows the second crop, or first growth of thirty-five days, after taking off the original crop; the wealth of herbage herein giving an early indication of a successful issue to the demonstration. Fig. 8 shows the second, or next, growth on the same land, thirty-five days later, and Figs 9 and 10 the third and fourth crops, respectively, on the same land, each thirty-five days later again. Fig. 10 shows the last crop of that land consumed in the test, and other lands throughout the paddocks were very similar.

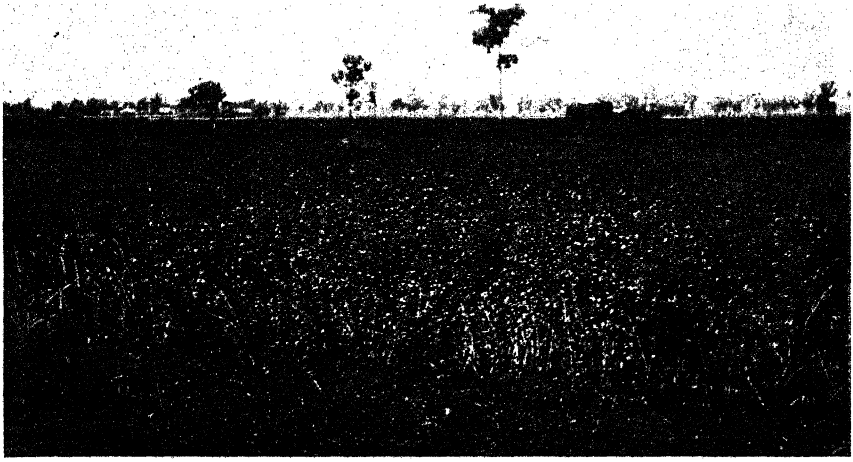


Fig. 10.—Fourth crop.

It will be noticed in each illustration that the bloom is just well on the plant, being the time when the plant is at its highest nutrient value. The lucerne was cut and carted to the sheep twice daily, as fresh as possible. When inconvenient to cut more than once, that one would always be for the evening meal and the following morning, the latter portion being cocked immediately it was cut, to prevent drying.

Fig. 11 shows the state of the paddock at the conclusion of the test (2nd March), the luxuriance of the growth then standing indicating that the test could be continued for a much longer period. The team is seen drawing out the last load of fodder given to the sheep under official supervision. There was also about 6 tons of the hay still in stack, being held in reserve for contingencies.

Several times I measured portions of the lands, cut and weighed the produce, and found it to be 10 and 12 tons of green fodder per acre, but on the western end of the paddock—Nos. 6 and 7 lands, where the soil took more of a clayey nature—the produce would be about

8 tons. The hay made from these cuttings I found to weigh one-fourth of the green cut. These lands were irrigated as soon after cutting as convenient, but it was noticeable that the quantity of resulting produce depended greatly on the care with which the water had been applied, and success was rather the result of management than of either soil or water. Simple as irrigation may seem, the best of conditions and appliances are of but little avail without intelligent and faithful labour.

Fig. 11.—Crop at Conclusion of Experiment.

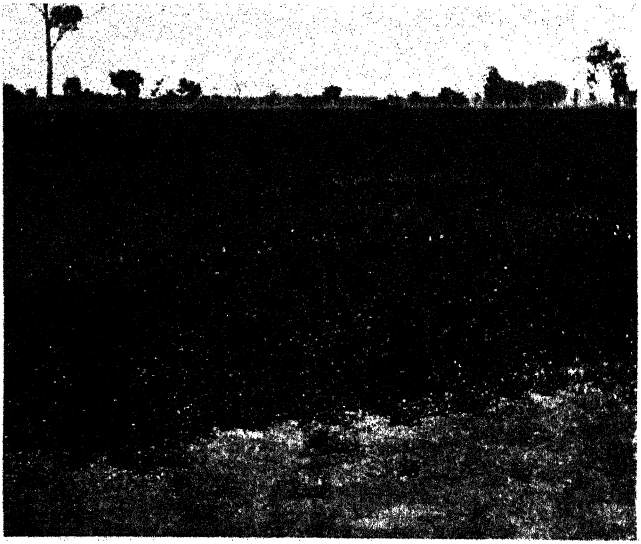


Fig. 12.—Bare patches which the water has not reached.

A small instance of this is shown in Fig. 12, where the irrigator has failed to water a portion of the land, consequently there is absolutely no vegetation, whilst within a few inches, where the water has been, the lucerne is growing in luxuriance, over 3 feet high.

The cost of production, including interest on capital and depreciation, with watering, cutting, and cocking for carting to sheep, is found to be 1s. per ton of green fodder.

It is but right to mention that this paddock of 22½ acres not only fed the required number of test sheep (1,687) but very frequently, and for weeks, thirty or forty sheep extra. The feeding paddocks known as "Galloway" and "Starvation" being alongside the public road, and Mr. Gatenby being recognised as one of "a good sort," passing drovers, with weak sheep and anxious to be relieved of them without loss, would drop them over the fences, to be claimed at a more convenient time. Three draught horses were also fed from it for the whole period.

## C.—The Sheep.

Two flocks of sheep were brought in from a back station, where they were eking out an existence under the starving drought conditions then common to the district. One flock consisted of merinos, mixed sexes and all ages, generally in fair store condition; the others were crossbreds similarly mixed, but in very low condition, with many so weak that they could hardly crawl along. Notwithstanding this they were retained, and used for the purposes of this test from a consideration that almost any station would have such sheep at a time of drought, and also a desire to make the test as crucial as possible. Five hundred and sixty-two merino ewes were counted off from the first lot and put into 30 acres, commonly known as the "Starvation" paddock. Five hundred and sixty-two crossbred wethers were counted off and put into the "Galloway" paddock of 30 acres, and a mixed lot of five hundred and sixty-two was made up from both flocks—crossbred ewes and wethers and merino ewes. These were put into a similar paddock called the "Reserve." Each of these enclosures was as absolutely bare of any edible vegetation as it was possible for it to be, and the sheep were entirely dependent on the food to be supplied. The first-named paddock was watered by the Lachlan River and had good shade and shelter, whilst the second and third had tank water, but suitable shade and shelter were very deficient. Fig. 13 shows the state of "Galloway" and the absence of either vegetation, shade, or shelter. The "Reserve" was in a very similar state, and "Starvation" is seen in Fig. 14.

The whole of the sheep had been machine shorn about a fortnight or three weeks previously.

On the evening of the first day of my taking charge, these lots of sheep were placed in their respective paddocks and fed, at which time a cool rain commenced and 1 inch fell in the next twelve hours, the thermometer falling from 60° F. to 44° F. As a consequence of this sudden change we found that 120 of the test sheep had died. This I attribute to the sheep going into strange camps at nightfall without being able to find sufficient shelter. No doubt their constitutions were impaired greatly by the drought, but the other flocks in Jemalong in their regular camps hardly suffered in any way that night, evidently showing that the want of shelter was chiefly responsible for the loss; but again our loss was trifling in comparison with others. We afterwards learned that on other stations of the district the cold snap of that night severely punished the small surviving remnants of drought-stricken flocks, reducing their already thinned numbers by another 50,000. The flocks of some stations were practically wiped out of existence. It was not convenient until the 29th October to replace the lost sheep, when the numbers were made up and the test then really commenced. Ten sheep from each flock were selected as truly representing the average ages and conditions of their flocks. Each of these sheep was numbered and weighed and these were always considered as representing the whole flocks. Of course they ran with the others and existed under same conditions.

Fig. 13.—View of "Galloway" paddock—typical of the surrounding country—in which the sheep under trial were kept.

The mode of feeding was by carting out the lucerne to the sheep, the carter taking to each lot a uniform quantity twice daily, and as the team passed along through the paddock he pitched the feed from the top of the load to the ground, giving an average of a fair forkful for each sheep. There was but little rushing or running after the cart, as is the case with starving sheep, for they seemed to recognise that they would each have a sufficient feed. Fig. 14 shows the sheep taking their feed in "Starvation" paddock, the team having just passed along.

Fig. 14.—Sheep being fed.

It has been repeatedly asked why were so many sheep confined in such small areas? I reply, this was done to satisfy the public that they could get no food except what was given to them. Had they been placed in good-sized paddocks, even at a sheep to the acre, nothing would convince many sheep owners and others that the sheep had not found plenty of other pickings of food, especially if rain fell during the test period.

No doubt the sheep were heavily handicapped by being so confined, and in such uncongenial surroundings, and if they could have roamed and fed over clean ground, and taken shade and shelter from blazing sun and blasting winds, they would on the same food have come out much better at the conclusion. Indeed, it is a fact that for the latter half of December and three-fourths of January the sheep in "Galloway" and "Reserve" were positively out of health from these causes, and it was only when the weather became a little cooler that they recovered themselves; then they improved rapidly. Had the test continued another month at the then lower temperature, I am of opinion that the sheep would have each put on another 4 lb. in weight. As it was, they did remarkably well under the trying circumstances of this unusually severe test. During the first month they fell away—as was expected they would—to the extent of 1½ lb. per head, through fretting at being so shut up in their new quarters, which they evidently disliked, and their condition varied to some extent with the climatic changes, but at the final weighing it was found the sheep had made an average gain of a little over 3 lb. each, with a fair growth of clean bright wool.

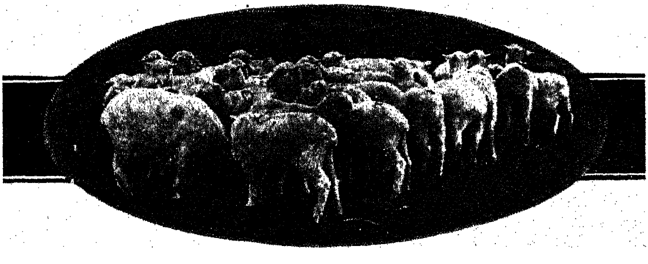


**Fig. 15.—An average lot of the sheep at conclusion of experiment.**

(Two of these sheep were exhibited and killed at the Royal Show, with the Grenfell District Exhibit.)

The losses by death during the period of the test were infinitesimal, and far below the average losses of sheep stations under normal conditions. Only one sheep died, while two others were run over by the fodder cart and succumed to their injuries.

The question is continually asked: will this system pay under normal conditions. I am quite satisfied from my experience, confirmed at Jemalong, that from 1 acre of good lucerne fifty sheep per annum may be primely fattened for the Homebush market; and in saying this I am keeping well within the mark.

## D.—Conclusion.

The experience of the past has taught us that only by water conservation and irrigation can drought in Australia be successfully fought, and the heavy stock losses of such periods, both individual and communal, be reduced to a minimum. Mr. Gatenby has proved beyond all question that the method of stock feeding adopted by him may be carried out much more cheaply and expeditiously than that of importing dry fodder from a distance, to which many stock owners were compelled to resort during the last and previous drought seasons. It may be mentioned in this connection that on one station alone, within 20 miles of Jemalong, no less a sum than £125,000 was expended in the purchase of fodder for the starving sheep last year, while other instances might be given of run holders having lost all their stock after spending many thousands of pounds in the effort to keep them alive until rain came and the grass grew. The time has arrived for both States and Federal Governments to give attention—special, earnest, prompt—to the solution of the whole water problem, to the end that the over-supply of good seasons may be made to meet the needs of the bad. Taking the district of which Forbes is the centre, the conservation of the waters at the head of the Lachlan (say about Cowra, where it is authoritatively stated that 62,000,000,000 gallons could be impounded at an outlay of about £250,000) in the volume possible during the recurring seasons of superabundance would serve the whole river length for all purposes, all the year round. And what a mine of wealth would be opened to the State if the district along the Lachlan, where it is estimated that 50,000 acres of land are suitable for irrigation, were watered fairly! It is almost an ideal fruit district, one marked peculiarity being that all the English and some tropical fruits can be produced at the same time, as fine as any that one could desire to see; and under favourable conditions the very best fruits could be produced in quantity more than sufficient to meet the whole of the requirements of the State. While

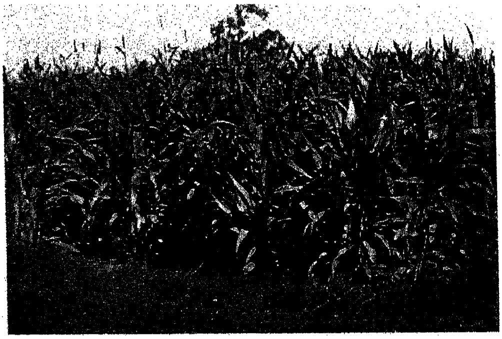
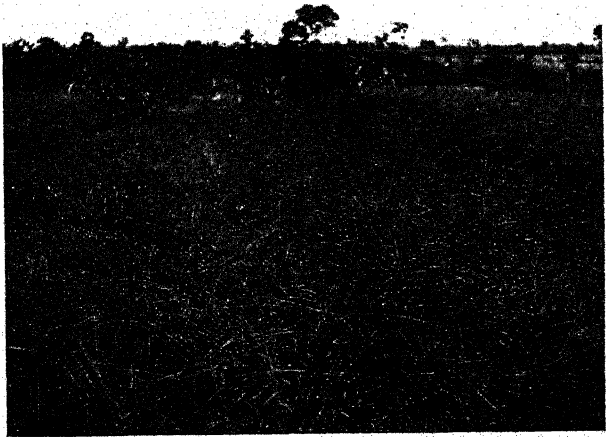


Fig. 16.—A Crop of Irrigated Sorghum at Jemalong; eight weeks' growth, 10 feet high.

I was at Jemalong, apricots as fine as any I ever saw were bearing down the trees, and most luscious peaches (growing in abundance also), the like of which I had not tasted or seen for twenty years; while the plums, pears, apples, grapes (these latter produced in tons) were surpassingly good. Citrus fruit was also growing there in abundance, the oranges up to 2 lb. in weight, and the lemons perfect in shape, colour and quality. And all the fruit and trees were clean, being perfectly free from both insect and fungoid pests. The same remarks apply to vegetables, the variety, quantity and quality of which were really surprising. Surely if water conservation and irrigation are all that is needed to secure sufficient for all State requirements in this district alone, the wise course is to enlarge operations in that direction, perfecting the means already adopted for maintaining supplies in times of drought, and extending them to the widest possible limit consistent with national reproductiveness; and at the same time opening up the land for the settlement of a thriving population, at least tenfold larger than that sustained at present. The experiment at Jemalong is an object lesson to all graziers and farmers in the dry country, and not only there, but in the more settled parts, which are subject to partial failure by reason of frequently recurring droughts.

## PASPALUM DILATATUM.

I WAS much pleased with the illustrations of *Paspalum dilatatum* in the *Gazette* of March last. They show well the very rapid growth made by this valuable grass, under favourable conditions, although the results in the North Coast districts greatly exceed these. It is without doubt the best grass the dairymen have at the present time for the production of both milk and butter, but I find it is little known except along the coast. As a stand-by for the stations, to be



Paspalum Grass at Jemalong.

planted here and there, wherever suitable conditions occur, it would be found invaluable for cows and ewes and their young. As an illustration of rapid and vigorous growth, I send you the accompanying photo. I may say, in explanation, that towards the end of October last I sent to the Hawkesbury Agricultural College for some roots of this grass. Although it was an unseasonable time for the removal of growing plants, I had sufficient faith in the robust vitality of the plant to risk the experiment. The said roots, however, from one unfortunate cause or another, could not be replanted until the end of November, by which time, as may be imagined, they were "pretty sick." They were then placed on Mr. Gatenby's Jemalong Station. Those showing any signs of life were subdivided as far as practicable for the sake of getting the larger number of plants, and placed every 18 inches, in rows 27 inches apart. Within a week all, with the exception of about 3 per cent., were visible above ground. Each root had a quart of water when being set, and a light irrigation three weeks afterwards; beyond this no water and almost no rain, with a rather high temperature all the time. On February 28 the accompanying photo. was taken, showing the growth made in three months, many of the plants having thrown up over thirty strong stems with plenty of herbage, the ground being nearly one-third covered.—A. A. Dunnicliffe.

## Orange Borers at Kurrajong.

One of the most troublesome pests with which the orange grower has to contend is the grub of the elephant beetle. The Entomologist has just paid a visit to the Kurrajong district, where the pest has been bad this season. The beetles lay their eggs in the bark of the trunk of the tree. When the larvæ or grubs hatch out they bore into the trunk, and if unchecked will destroy the tree. Where the punctures are noticeable orchardists are able to gouge the grubs out (as many as 40 grubs have thus been removed from a single trunk), but generally the damage goes on unobserved. Mr. Froggatt suggested some time ago, when the orchards around Windsor were having rather a bad time of it with borers, that if earth were heaped around the base of the trunk the beetles may be prevented from depositing their eggs, and where the plan has been tried it has been fairly successful. The best method, however, would be to keep the stems of the trees well covered with some wash, such as carbolic and soap. Mr. Peck, of Kurrajong, informed Mr. Froggatt, that a number of trees that were treated early in the year with Bordeaux mixture are very free from the borer. Old trees seem to be more subject to damage as a general rule, and some old peach and apple trees have been infested. As the beetles first appear early in October, it would be advisable to wash them and make periodical inspections of the trunks throughout the summer.

# Producing Beef on Farms.

At one time it was the general practice, and is in some districts still customary, for dairy-farmers to knock on the head within a few days or hours of their birth all bull calves not intended for stud purposes. A few used to keep these calves for disposal as vealers. A question worthy of consideration is whether it would not be a profitable undertaking to rear such calves, and sell them as beef steers at a couple of years of age. Beef raised in such a way would nearly always command top prices.

In the United States of America the rearing of beef cattle on ranches is carried out on a scale even more extensive than prevails on the stations of New South Wales and Queensland, but, notwithstanding the enormous number of cattle thus bred, there appear to be still plenty of openings for the farm-raised steers. The conditions under which the American farmer grows beef are less favourable than those which the farmer in the coastal and table-land districts of New South Wales has to meet. The stock raiser in the United States has to make provision every year against winter. The cold weather shuts down on him like a vise. If he is unprepared, he is just snuffed out like a candle. In this State, where a man takes up the rearing of a limited number of stock in districts which carry cows on grass nearly all the year round, it is scarcely likely that, with such readily saleable stock as young steers, he could ever come to serious grief. If, despite his best efforts, the farmer should find his pasture or stored fodder insufficient to carry all the young bullocks to maturity, he can always sell down to the limit of what can be provided for without purchasing food.

In looking around for information that will be of guidance to farmers in the more humid districts of New South Wales who would care to embark in this industry, one feels that it would not be possible to do better than to reproduce the opinions expressed by Professor E. A. Burnett, Director of the Nebraska Experiment Station, at the last annual meeting of the Kansas State Board of Agriculture.

"Growing beef or keeping live stock on the farm throughout the year," said Professor Burnett, "involves a change of methods on those farms where cattle are now kept only in the feed lot during the winter months to consume the crops of the previous year. It requires more meadow and pasture land, smaller areas of corn (maize) better tilled, better care of all straw and coarse forage, the introduction of the corn binder and shredder where stalk fields have previously been fed off by stock cattle, the better fencing of land, and an adequate water supply. Good blood is also a paramount necessity. Well-bred animals respond to feed. They have inherited a habit of laying on flesh when well fed. These conditions come only with intensive methods—no other methods have any place on high-priced land. Intensive methods do not necessarily mean increase of labour along all lines, *e.g.*, a decrease of labour results from increasing the pasture area. It also saves labour to the steer.

"The great demand on the farms all over the country is for more grass. This idea was once considered erroneous, and, with increasing values, grass lands were ploughed and planted to maize. The Mississippi Valley lands were thought to be so rich that they would bear indefinite cropping; but forty years of maize-growing has decreased the yield perceptibly. The new land produces better than the old. It has not had time to run out. A small crop on high-priced land gives no profit. Sentiment is now increasing in favour of laying land down to grass, thereby increasing its supply of humus and water holding capacity in order to increase its producing and rent-paying power. Grass rests the land, fills it with root fibres, increases the available nitrogen, helps it to withstand extremes of wet and dry weather by making it more porous, and, when again put into the rotation, enriched and fructified, it pays rental on an increased valuation or greater profits on its former value. If while thus being enriched it can be made to pay a reasonable revenue by producing 'baby beef,' the farmer is certainly the gainer thereby.

"The producer of economical beef can never get away from grass. If land is high priced it must produce a larger tonnage or make more beef to the acre. If pasturing land six months does not pay, we must learn how to pasture eight months. We have produced too little beef by grazing too many animals per acre. If growing three-cent beef on grass does not pay, we must instead learn how to grow beef worth 5 and 6 cents per lb.

"Where heavy steers are purchased to put in the feed lot, there is a great waste of forage in the form of stalk-fields. This waste must be entirely cut off. The maize binder and the shredder must come in to save the maize stover which is now largely wasted. It is not too much to say that the binder and shredder would increase the value of the corn fodder in Kansas and Nebraska six-fold above its present value. As from one-third to two-fifths of the value of the crop is in the stalks, when harvested in the most approved manner, it is easy to estimate how great is the loss on a corn crop of 225,000,000 bushels. Figuring the stalks as two-fifths of the crop, their nutrient value would be two-thirds of 225,000,000, or equal to 150,000,000 bushels of maize. I do not know how many acres of these stalks are left standing in the field; but assuming that not more than one-third are cut, and that five-sixths of the value is lost where stalk fields are pastured, we have a net loss the equivalent in feeding value of 82,000,000 bushels of corn in the single State of Kansas in an ordinary maize year. I have gone thus into detail relative to the losses on the maize crop, because I consider it one of the great factors in growing beef on high-priced land. Kansas is fortunate in being blessed with a soil and climate suitable for the abundant growth of lucerne, for it, along with sorghums and maize fodder, form our chief sources of forage which are essential to the growing of cattle.

"With grass, forage, and grains and the waste products of the farm to be consumed, it is important that the cattle kept on the farm shall be of such a quality as to make good gains, mature early, and produce a high quality of beef. The scrub must give place on high-priced land to the Angus, the Hereford, the Shorthorn, and the other beef breeds which can be grown and finished for the market in from eighteen to twenty-four months, and be sold at the top of the market. If inferior cattle should make equal gains for the food consumed they still produce an inferior grade of carcase, which is worth from 10 to 25 per cent. less than the well-bred and well-grown steer. If the inferior steer is produced without loss, the premium on the better steer is profit. There is a very great difference in the value per pound of a well-bred calf and a scrub. The well-bred calf pays you a profit on every bushel of maize and every ton of lucerne he eats. He is an embryo gold-mine as he waits to be shunted down prosperity track; the other calf has a hang-dog look. He had much better be hung young. The feeder of mature cattle often selects inferior grades of steers, off colours, &c., on account of their lower cost as feeders, and claims there is greater profit in them. This may be true with the man who feeds, but how about the man who raised the feeder? If good feeders sometimes sell for more than they are worth, this is a convincing argument in favour of raising them.

"The question is being raised whether we can afford to keep a cow the entire year to raise a calf. If so, the calf must have breeding and quality. He must be a rent-payer. Moreover, the mother must be a scavenger; she must live on cheap foods. To be a scavenger does not mean starvation. These foods must be nutritious, cut early, and preserved from the weather; but coarser foods than the calf will use to make baby beef.

"There is economy in keeping breeding stock on the farm. They consume the coarse products. The straw and the maize fodder (stalks) need to be picked up. Some of the hay is not of the best quality. There is land to be enriched by pasturing, so that always on the farm a certain number of breeding cows can be kept. Perhaps ten to fifteen per quarter section (40 acres) can be maintained at a very low cost, even below the cost of purchasing a good calf.

"How, then, shall we handle the 'beef steer and his baby sister' to make them rent payers. If the breeding herd act as scavengers, the steer must be forced to his best growth on foods of good quality. The farmer on one hundred-dollar land has no place for a steer after he is twenty-four months old. Probably most of these steers will drop in February, March, or April. The cows take less feed if dry in winter. They are better scavengers. They give more milk for the calf in summer. After weaning time the calf will be pushed along, perhaps fed some before. He will be grown through his first winter on lucerne and a liberal ration of maize or mixed grains, and in summer fed on grass for the Christmas market. A March calf will thus have twenty months in which to prepare for the block. He should weigh approximately 1,200 lb., and sell at six cents per lb. on an average market. To the careful stockman the production of beef in this manner is not burdened with many intricate details. My own plan would be to use good grade cows with considerable Shorthorn blood, and preferably use Hereford or Angus bulls, as the steers would probably mature earlier, and at twenty months would be riper than when produced largely with Shorthorn blood. The Shorthorn dam is an advantage as she is a good suckler, and will raise a larger, stronger calf in consequence. This calf should learn to eat grain before he is fully weaned, and should, if possible, go into a fresh pasture at weaning time—a lucerne meadow with grass about knee high to the calf. The calf is an unsophisticated creature. He thinks he is in clover. A small feed of oats, or possibly of Kaffir corn, both of which will check any tendency to scour, give the calf a good start.

"In baby beef the grain is important. Grain sticks to a calf's ribs, his whole body is made up of little hungry cells, reaching out to seize the nutrients in the blood, and store up fat, bone, muscle. The calf's digestive and nutritive system works all the time, the cells are active and watchful for every particle of food which passes their way. It is so with all growing things, but the digestive tract is weaker than in the great sluggish ox who works only half time. The food must be selected more carefully. The muscles and bones are growing, they need more flesh and blood forming food—more protein. They are young, they cannot handle hay in cartloads, like the horse, they need a mixed ration, corn and oats and barley to furnish energy and keep them warm, while the lucerne furnishes protein to make muscle and blood.

" A balanced ration is simply a ration which meets the needs of the animal. It is not one-sided. It does not furnish too much protein or too little, and so waste a part of the ration. A balanced ration may be grown on the farm, indeed it should be grown on the farm. Lucerne hay has too much protein, corn has too little, they balance each other. Lucerne and some other roughness like corn stover may be fed together. Straw helps to keep lucerne from scouring the cattle.

"In baby beef the first winter is of great importance, not a day should be lost. At least one half of the ration should be concentrates. With lucerne for roughness the grain ration is easily grown on the farm. Maize, Kaffir corn, and, for the sake of variety, some oats or bran should be fed. This year (1902) wheat shorts are very cheap with us in Nebraska. They could be economically mixed with three-quarters corn to give variety. I should not full feed these steers until they go on pasture. An early blue grass or brome grass pasture is very desirable in making baby beef. You can get on to it early, and get on full feed sooner. Orchard grass and meadow fescue make good pastures in Nebraska, with a little lucerne mixed in. Sow 4 lb. of lucerne to the acre with grasses for pasture. Soaked maize or corn chop make a good ration on grass. I believe in adding 10 per cent. oil cake or cotton-seed meal during the last 100 days of the feeding period.

"This forcing process has some disadvantage, viz., it requires that growth be made upon concentrated and high-priced feed which might be made upon grass alone by giving more time before the period of heavy grain-feeding begins, but it has some distinctive advantages.

This process permits us to make beef on young animals, which always costs less per lb. than on mature steers. In my own experience I have fed steers continuously upon a grain ration, and marketed them at thirty months where only 650 lb. of grain was required for 100 lb. of gain. Many experiments with mature steers show a cost of 1,000 to 1,400 lb. of grain for each 100 lb. of gain produced; but they have the advantage of a much shorter feeding period, and depend mainly for the profit on the increase in value of the original weight.

## Beef Production and Dairying.

"This method of beef production may be profitable as long as the breeding cow can be kept a year for the price of the calf at weaning time; but there comes a time when this cannot be done. The cow becomes a boarder or the calf comes too high. There are but two things to be done—buy the calf or milk the cow. The cow which will not pay a profit on the calf alone will easily pay a profit on the food and labour involved, if she can be made to produce 200 lb. of butter per year in addition to the calf. Can this be done and a good steer produced? It certainly can; but methods must be changed. The cow can no longer be made the scavenger. For nine months of the year she must have the best of feed, for three months she will consume a good deal of roughness. In summer, good pasture supplemented by lucerne grass or hay and green forage crops in case of a drought. The farmer will probably be obliged to build a silo. It will double the stock-carrying capacity of his farm. This herd of cows will be bred much the same as in the previous case; but more attention will be given to selecting cows which combine milking quality with size and reasonable flesh-carrying capacity. 200 lb. of butter per year is not an exorbitant yield. Many cows do more with advanced methods; this means from £6 to £8 revenue for the butter fat. The skim milk from a hand separator supplemented by a grain ration will raise nearly as good a calf. I imagine I hear this statement questioned, and I admit that here is where the skill of the farmer comes in. If he does not know how to feed a calf to get the best results, he must learn. Warm sweet milk, a little maize meal, Kaffir corn, or whole oats. A little dried blood in case of a tendency to scour, lucerne, and prairie hay, sunlight, and fresh air. There should be a bond of sympathy between the calf and the feeder to enable the latter to anticipate the wants of the calf and provide them. If he does not show the bloom of a suckler he will take it on before he goes to the block. Many calves which have been grown for beef by the hand-feeding process have developed form and finish which fill all the demands of the market. The champion Shorthorn steer at the International, 1902, was a hand-fed calf.

"But how shall these milking cows be bred to produce calves with early maturity and beef quality? In just the same way which was before recommended, except that, if necessary, more pains will be taken to use compact, early, maturing, thick-fleshed sires. Both steers and heifers will be sent to the block. A friend of mine is now practising the following method:—A herd of good milking Shorthorn cows is being bred to an Angus bull of the type mentioned, except a few of the largest milkers, which are being bred to a Holstein-Friesian bull. The calves are transferred to the poorer milking cows, two calves suckling each cow. One-half of the cows are milked and butter made from them. The Shorthorn-Angus calves are of high beef quality. The Holstein-Shorthorn heifers are expected to make most excellent cows, and the Angus bull will cover up the Holstein markings in their progeny. The Holstein-Shorthorn bull calf leaves something to be desired so far as quality is concerned. This process of raising steers from a milking herd raises a problem not presented in the beef herd. The cow cannot act largely as a scavenger. The steer must be the scavenger without being starved or greatly stunted in growth. He must eat the rough feed. His grain ration the first winter will be reduced. Instead of receiving one-half of his ration in grain, he will not receive more than one-fourth grain. The summer he is one year old he will live on pasture and forage crops only. He will not make Christmas beef that year, but will eat up the coarse feed on the farm and be summer fed as a two-year-old or carried over and fed the following winter, reaching the market at about thirty-six months. The strong factor in the production of these steers is that they have been grown on grass and coarse foods with a short finishing period.

"Methods of feeding must be studied. High-priced land demands high-priced products, unless you can greatly increase the yield. Thirty-cent. maize cannot be fed by the same wasteful methods which we practised when it was worth 10 cents. We must spend more labour upon it; we must mix more brains with it to balance the ration. If we are short on brains we may substitute lucerne hay. The amount of food necessary to produce 100 pounds of gain varies greatly under different conditions. As much as 37 per cent. of the feed is saved when soy beans are fed with maize to hogs over feeding maize alone. In other instances 25 per cent. of the feed was saved by feeding a balanced ration to steers over feeding maize and maize stover. All this has been done in Kansas, where people know how. It took brains to find out. Then why not balance the ration? The great bugbear has been the cost. Protein is high-priced, but the farmers of Kansas and Nebraska have grown the protein—now it is cheap. Lucerne hay, at 5 dollars per ton, makes protein so cheap that we have no excuse for stinting the calf on blood and body builders. He takes it too much to heart; it does not pay.

"Five tons of lucerne hay will balance the ration for 5 tons of maize in making baby beef. It will do more with mature steers. With 25 per cent. of the land in lucerne and soy beans there will be no lack of protein to feed a dairy herd and raise baby beef. The work of the Kansas Experiment Station in bringing out the value of the soy bean has been worth more to the farmers of the State than the Kansas Agricultural College ever cost.

"You can feed too much protein to get the most fat. We waste our carbohydrates in the stalk-fields; we let them weather and spoil, thinking we have something better. We have not time to cut maize.

The fact is we have too much land. Our grandchildren will cut the farms in two; they will cut the corn fodder into silage; they will mix lucerne with it; they will have learned how.

"Baby beef assumes there is a pig somewhere. He is the mascot of the steer; he protects the profits; he once lived on maize or died of cholera. Lucerne has helped the pig; he has balanced the ration as far as he can. Lucerne is not enough. It is too bulky, unless you grow the pig and then fatten him. The soy bean helps out, wheat helps also; it is better than corn, but it is often too expensive. Dried blood and tankage and ground bone may be used, especially for breeding animals. They strengthen the bone, and give muscle and blood-building material.

"When grown the steer must be marketed. If he is fat, and a good beast, he will top the market; but the market must be had. The feeder of baby beef has an advantage. Baby beef may be kept on for some months beyond the time we had expected to sell. It will continue to gain, and nearly, or quite, pay for the feed. In the meantime the market may mend, and you sell at a profit. With heavy steers you do not have so much leeway. They get ripe and must go. The purchaser of cattle for the feed lot must be a good buyer or he gets sold. The man who raises his cattle gets all the profits, and does not have the risk.

"Kansas and Nebraska possess natural advantages for feeding. They have a dry climate and genial skies. A dry feed-yard has a great advantage over a yard knee-deep in mud or a steaming, filthy stable. A dry bed is no fiction in the profits of steer-feeding. The steer swells most when lying down. He then puts fat on his ribs. The man who grows baby beef must be skilful. He is dealing with young, tender things. He needs a sympathetic knowledge of the animal—an intuition as to its needs.

"Baby beef production has come to stay. It is largely independent of the business of the large feeder who buys mature cattle, and will become more and more so as the supply of range cattle decreases. It can be carried on by the small farmer who makes a practice of growing what he feeds and feeding what he grows. Under this system the land grows richer. As land gets higher-priced its rent-paying power increases, because of its increased productiveness. We know that baby beef is the most economical from the standpoint of beef produced to food consumed. We know that it possesses the highest quality with the smallest per cent. of waste. It must, therefore, be most economical. To produce it requires the greatest skill. It must eventually pay the greatest profit."

# Crops at Wagga Farm.

G. M. McKEOWN.

In common with the greater portion of this and the adjoining States this district has borne its share of drought with all its attendant evils.

As will be learned by the appended statement of rainfall there was no reserve of moisture in the subsoil to start and maintain growth in the crops, and the supply received during the time the crop was in the ground was insufficient for its proper maintenance. The results are therefore far below our average, while, with the exception of a few instances, the crops of the district failed entirely.

The whole of Paddock No. 5, detailed yield of which is appended, was intended for a comparison of varieties under, as nearly as possible, equal conditions.

The soil consists of a greyish loam, the portion cultivated this season being fairly even in quality. With the exception of Nos. 1, 5, and 22, the blocks which were about 45 chains in length contained one or more large box trees in each, and their absorption of moisture considerably affected the crop within the range of their roots. The whole of the land was manured with bone-phosphate, at the rate of 53 lb. per acre, with the exception of portion of No. 14. A portion (about one third) of the paddock was manured with superphosphates in 1897 and 1899, and in the meantime the land remained uncropped after the harvest of the latter year. In the winter and spring of 1901 it was broken up by means of mould-board ploughs, and was afterwards harrowed. Just before sowing it was again cultivated with scarifiers,

Crop of Farmer's Friend.

disc cultivators, &c. The seed was sown from 8th May to 20th May, but none appeared above ground till well on in June, the moisture being insufficient to give the crop a start. The crop in this paddock yielded far better than any others on the farm although, to some extent, handicapped by eucalypts, as described.

Crop of Berthoud.

A good illustration of the growth of a crop, when aided by a little extra moisture, may be obtained by comparing the accompanying photographs of portions of the headlands which had received the water which ran off the road, with the remainder of the crop which was not so assisted.

Crop of Australian Talavera.

Paddock No. 1A contained the comparisons which it has been my practice to make each year with varying quantities of seed, manure, &c. The value of the results is affected by it having been necessary to abandon the old variety with which the tests have been conducted in order to carry out instructions to sow a large area of a new variety which is not so suitable for this district as that formerly used, viz., Farmer's Friend. This paddock in 1900 bore a crop of barley which was fed off by sheep, and in 1901 a crop of wheaten hay was harvested, it having been cut while quite green.

## Wheat for Hay.

The seed was sown in April; the variety used being chiefly Berthoud. The crop did not show above ground till well on in June, after the showers which fell in that month. Seed was sown at the rate of 45 lb. per acre, and manure was drilled in with it at 60 lb. per acre. A portion of the crop was harrowed when about 4 inches high, and part was left unharrowed for the purpose of comparison; the yield from the former being 51 lb. per acre more than the latter.

An area top-dressed with dried nightsoil returned 90 lb. per acre less than the adjoining block not so treated.

*Hay Crops.*

COMPARISON of Manures.

| | Area. | Yield per acre. |
|---|---|---|
| No manure ... ... ... ... ... ... | 10 acres ... | 3 cwt. 0 qrs. 9 lb. |
| No. 1 manure, 65 lb. per acre ... ... ... | 15 ,, ... | 3 ,, 0 ,, 2 ,, |
| No. 2 ,, 65 ,, ... ... ... | 62½ ,, ... | 4 ,, 3 ,, 0 ,, |
| No. 2* ,, 65 ,, ... ... ... | 11½ ,, ... | 3 ,, 3 ,, 22 ,, |

*Top-dressed with nightsoil.

Harrowed *v.* Unharrowed.

| | | |
|---|---|---|
| Harrowed.—No 2 manure, 65 lb. per acre ... | 43¼ acres ... | 5 cwt. 0qrs. 22 lb. |
| Not harrowed.—No. 2 manure, 65 lb. per acre ... | 62½ ., ... | 4 ,, 2 ,, 27 ,, |

| *Varying Quantities of Seed.*<br>Area, 4 ac. 2 r. 8 p. each. | | | | *Varying Quantities of Manure.*<br>30 lb. seed per acre. | | | |
|---|---|---|---|---|---|---|---|
| Variety of wheat. | Seed per acre. | Manure per acre. | Grain per acre. | Variety of wheat. | Manure per acre (B., bone phosphate). | Cost of manure per acre. | Grain per acre. |
| | | | | | lb. | s. d. | bus. lb. |
| | lb. | | bus. lb. | Jonathan | None. | .. ... | 1 9 |
| Jonathan | 20 | 60 lb. B. bone-phosphate. | 1 34 | | 25 | 1 2 | 0 48 |
| | 30 | | 1 49 | | 35 | 1 9 | 0 44 |
| | 40 | | 1 15 | | 60 | 2 9 | 1 49 |
| | 60 | | 1 58 | | 80 | 4 0 | 2 0 |

### *Paddock No.* 5.

### COMPARISON of Varieties.

| Variety. | Area. | | | Grain per acre. | |
|---|---|---|---|---|---|
| | a. | r. | p. | bus. | lb. |
| Schneider | 4 | 1 | 3 | 7 | 25 |
| Farmer's Friend | 9 | 1 | 33 | 6 | 31 |
| Hudson's Early P.L. | 9 | 3 | 19 | 6 | 26 |
| White Essex | 4 | 3 | 3 | 6 | 24 |
| Sussex | 1 | 2 | 9 | 6 | 17 |
| Steinwedel | 2 | 0 | 14 | 6 | 15 |
| Field Marshal | 2 | 0 | 14 | 6 | 11 |
| Steinlee | 2 | 0 | 14 | 6 | 6 |
| White Tuscan | 5 | 1 | 0 | 5 | 57 |
| Cumberland | 9 | 2 | 38 | 5 | 43 |
| Jade | 9 | 2 | 4 | 5 | 32 |
| Bobs | 9 | 1 | 38 | 5 | 30 |
| Federation | 4 | 2 | 35 | 5 | 20 |
| Australian Talavera B. | 25 | 1 | 28 | 4 | 57 |
| Nonpareil | 4 | 2 | 20 | 4 | 55 |
| Dart's Imperial | 5 | 1 | 0 | 4 | 51 |
| Lambrigg White Lammas | 26 | 0 | 20 | 4 | 38 |
| Tardent's Blue | 5 | 2 | 17 | 4 | 2 |
| Jonathan | 4 | 3 | 3 | 3 | 40 |
| Berthoud | 29 | 3 | 10 | 3 | 24 |
| Australian Talavera A. | 4 | 2 | 20 | 2 | 25 |
| Algerian | 2 | 0 | 14 | 3 | 12 |
| Poland | 10 | 0 | 0 | 1 | 19 |

### RAINFALL for Thirteen Months.

| 1901. | Points. | 1902. | Points. |
|---|---|---|---|
| November | 12 | July | 124 |
| December | 9 | August | 44 |
| 1902. | | September | 125 |
| January | 140 | October | 162 |
| February | 12 | November | 33 |
| March | 91 | | |
| April | 0 | | 9·18 |
| May | 15 | | inches. |
| June | 151 | | |

Average for 25 years, 22 in.

# Trial of Oats at Bathurst Farm, 1902-03.

R. W. PEACOCK.

THE season 1902 proved an unusually severe one for the oat crop, and if it had not been for the beneficial rains of the early part of December many of the varieties would have completely failed. These rains revived the late varieties completely, and allowed of their being harvested.

In all, 62 acres were sown, and yielded 393 bushels, or an average of 6 bushels 14 lb. per acre. Owing to the nature of the season, the crops ripened very unevenly, and the early growth shed its grain freely whilst waiting for the secondary and heavier growth to mature. All the varieties were harvested for grain on account of anticipating a scarcity of seed for the next season. Many of the yields were not comparable, on account of varying conditions of culture and soil. A comparative experiment was carried out with several varieties under conditions, as regards soil and treatment, which allowed of faithful comparisons. The main differences were due to the rainfall which favoured the later-maturing varieties.

The information gained from this experiment is valuable as regards their season of growth and their suitability for hay or chaff. The characteristic of early maturity in districts where a dry summer is the rule is most important, whereas in others, where the rains can be depended upon further into the summer, medium or late varieties may prove the most profitable.

In the following list coarse stem is represented by the letter C, fine stem by the letter F, and medium by the letter M. The height of crop also is given. E represents early; L, late maturing.

The following oats may be divided into two classes, viz., the Side-bearing, as the Tartarian, in which the spikelets are arranged upon one side, and the Tree, as the Potato-oat, with a more or less evenly-branching panicle. The letter S stands for Side-bearing, or Tartarian, and T for the Tree, or Potato, class :—

| | | Sown. | Harvested. | Height. | |
|---|---|---|---|---|---|
| | | | | ft. | in. |
| Skinless Oat ... ... | (EFT) | 23 May, 1902 | 4 Dec., 1902 | 2 | 0 |
| Algerian Oat ... ... | ,, | 23 ,, 1902 | 6 ,, 1902 | 2 | 0 |
| Red Rustproof ... ... | ,, | 23 ,, 1902 | 1 ,, 1902 | 2 | 0 |
| Clydesdale .. ... | (MTC) | 23 ,, 1902 | 27 ,, 1902 | 4 | 3 |
| Peerless White Bonanza | ,, | 23 ,, 1902 | 27 ,, 1902 | 4 | 6 |
| Carter's Royal Cluster | ,, | 23 ,, 1902 | 29 ,, 1902 | 4 | 6 |
| Hopetoun ... ... | ,, | 23 ,, 1902 | 29 ,, 1902 | 4 | 6 |
| Lincoln .. ... ... | ,, | 23 ,, 1902 | 30 ,, 1902 | 4 | 3 |
| Swedish ... ... ... | ,, | 23 ,, 1902 | 29 ,, 1902 | 4 | 3 |
| Black Winter ... ... | (LFT) | 23 ,, 1902 | 14 Jan., 1903 | 4 | 0 |
| Welcome ... ... | (LCT) | 23 ,, 1902 | 8 ,, 1903 | 4 | 3 |
| Egyptian ... ... | ,, | 23 ,, 1902 | 8 ,, 1903 | 4 | 6 |

| | | Sown. | Harvested. | Height. ft. | in. |
|---|---|---|---|---|---|
| Danish Island ... | ... (LCT) | 23 May, 1902 | 15 Jan., 1903 | 3 | 9 |
| Wide Awake ... | ... „ | 23 „ 1902 | 14 „ 1903 | 4 | 0 |
| Golden Giant ... | ... (LCS) | 23 „ 1902 | 22 „ 1903 | 4 | 0 |
| Tartar King .. | ... „ | 22 „ 1902 | 14 „ 1903 | 4 | 0 |
| Pioneer Oat ... | ... (LCT) | 22 „ 1902 | 14 „ 1903 | 3 | 3 |
| Waverley ... | ... (LMT) | 22 „ 1902 | 15 „ 1903 | 4 | 3 |
| Dun ... ... | ... (LFT) | 22 „ 1902 | 15 „ 1903 | 3 | 9 |
| White Tartarian | ... (LMS) | 22 „ 1902 | 22 „ 1903 | 4 | 0 |
| American Banner | ... (LMT) | 22 „ 1902 | 15 „ 1903 | 4 | 0 |
| Abundance ... | ... (LCT) | 22 „ 1902 | 22 „ 1903 | 4 | 0 |

It will be seen that many of these oats, although bearing different names, have many points of similarity, and cannot be considered as different varieties. Others are quite distinct, and can be recommended as likely to prove suitable for different centres of the State.

The Algerian and Red Rustproof, although alike in many important characteristics, differ very materially in others. They are very suitable for many districts where the later-maturing varieties are unable to thrive owing to the dry summers, as they mature before the excessive heat and hot winds of such regions. Their heights given in the table are deceptive, and cannot be taken in comparison with the others, as the conditions at their critical period were decidedly against them.

Under more favourable conditions they yield well, producing a high quality hay, containing a large proportion of grain to stem, and suitable for rack purposes.

Of the late varieties possessing fine stems and making good quality hay are the Black Winter and Dun.

The Waverley, White Tartarian, and American Banner are intermediate in this respect.

The others have much coarser stems, and are more suitable for chaffing, amongst the heaviest yielders being Carter's Royal Cluster, Peerless White Bonanza, and Hopetoun.

The comparative grain-yielding capacities of the different varieties could not be correctly estimated during the season, and nothing was done in this direction.

The studying of the seasons, of the varieties, and also the quality of their hay is of considerable importance, and may avert many blunders in the choice of unsuitable varieties for the climate and purposes required.

## SWINE-FEVER.

THE attention of pig-owners is specially directed to the information on the above disease given by Mr. Stanley at p. 464 of this issue.

# Some Wood-boring Beetles and their Habits.

By WALTER W. FROGGATT, F.L.S.
Government Entomologist.

The difficulty experienced in destroying the different kinds of wood-boring beetles in the various stages of their existence is very great, because in most cases the damage is done before the insects are noticed, and in some cases the wood is infested with the larvæ of the beetles before it is cut up and used for building, or made into furniture.

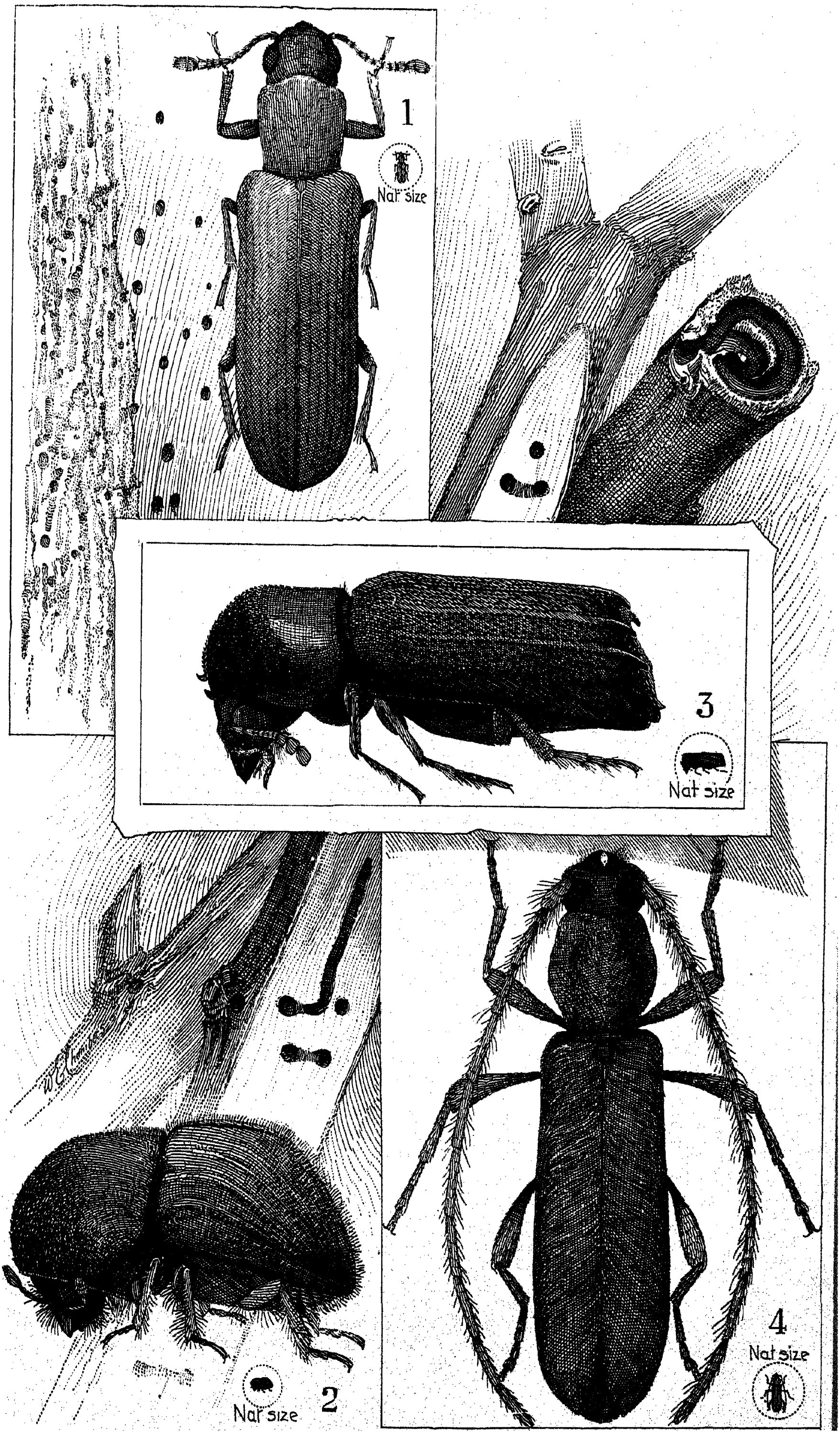
When the beetles simply bore into the wood the damage is apparent, but when they lay their eggs in the burrows the damage is intensified and the wood in many cases is reduced to dust, the work of reproduction of the species having been going on for years. Some very serious pests have been introduced into this and other countries in timber in this manner, so that it is often very difficult to say whether a wood-destroying beetle is a native or an introduced species. There has been a well-known pest in India (The Beer-cask Borer—*Hyleborus perforans*), which for many years has caused a great deal of damage to the casks of British beer stored for the soldiers, by burrowing into the staves, and causing them to leak and spoil the contents. Blandford has written a very interesting account of this pest in his Report of the "Destruction of Beer-casks in India by the attacks of a wood-boring beetle," 1893. He says, that for many years the identity of this beetle was a matter of doubt, as it was looked upon as an introduced species, but later researches have proved that it is a native of India, and attacks the casks after they have been stored.

As we have many letters about these kinds of pests the writer proposes to collect a number of notes on species troublesome in Australia that have come under his notice during the last few years. The "pin-hole" trouble of timber merchants is the result of the attacks of some undetermined species of *Scolytidae*, which is so partial to some species of eucalyptus timber that contractors do not like to use them, but as a general rule the "pin-holes" are only local, and unless very numerous only slightly detrimental to the durability of the timber.

### *The Wine-cask Beetle* (Bostrychus cylindricus, *Macl.*).

There is no previous record of this beetle having been noted as a destructive insect, though it was described by Macleay in his paper "On the Beetles of Gayndah," published in the Transactions of the Entomological Society of New South Wales, in 1871, and is common over a great part of this State.

Nearly two years ago specimens of this beetle were sent in with the information that they had damaged a number of casks belonging to the Pure Yeast Co., but nothing further was heard of the matter. Last month a number of specimens were sent in from Fairfield, where


1
Nat size
3
Nat size
2
Nat size
4
Nat size

they were destroying the wine-casks. A few weeks later I visited the vineyard and examined the damaged casks, some of which had contained wine when attacked, but were under a shed and not placed in the shelter of the wine cellar. No casks had been damaged in the cellars, and the injuries were confined to the half dozen in the shed.

Several of these casks were completely riddled both on the head and sides with the vertical shafts, about one-twelfth of an inch in diameter, which penetrated right through the staves; in most instances the beetles cut their way in at the junction of two staves, and where the edge of the head was thinnest, but others went straight through the solid wood. The owner's attention was first attracted to the casks by seeing the wine oozing out through the perforations, when he immediately set to work to remove the wine. He afterwards scalded the casks with boiling water, and plugged up all the holes he could find, and lime-washed them. These seem to be the only feasible methods of checking the evil, and are the only remedies or preventives suggested in Blandford's report on the Beer-cask Pest.

This being a native beetle must attack the casks from the outside, and is therefore not so dangerous as one introduced concealed in the timber. Its life-history is unknown, but like a number of allied species it probably feeds upon the dying bark of gum-trees, and will always be more likely to appear in numbers where timber has been cut down and allowed to remain on the ground through the season; the adult beetles come to feed upon and burrow beneath the dying bark in which they lay their eggs.

This beetle measures, up to the third of an inch in length, but is variable in size, and is of a regular cylindrical form, as its name implies. The colour is a uniform dark chestnut brown, shading to black on the dorsal surface, the head is turned down in front under the rounded cowl-like thorax, and comprises a pair of powerful jaws admirably adapted for boring through solid wood, while the large rounded eyes stand out on either side, and the antennae terminate in a three-lobed club. The rounded front portion of the thorax is roughened and covered with little bosses or spines, giving it a rugose appearance. The elytra or wing-covers are narrow, rounded over the body and covered with fine punctures, with the tip truncate and flattened, the sides produced into a series of three curled flanges or tails on either side. This is a species closely allied to the large "Auger" beetle, figured in this *Gazette*, as destroying the timber of dying or sick fruit-trees.

### *The Ambrosia Beetle* (Xyleborus solidus, *Erich.*).

A general account of the curious habits of this group of beetles was given in this *Gazette*, in Entomological Notes on specimens received during 1899, where a doubt was expressed whether these beetles ever attacked living fruit-trees, but further observation has proved that they do infest such fruit-trees.

Last year they appeared in considerable numbers in the Somersly district, near Gosford, both in apple and peach trees, perforating them with their winding tunnels, and killing off branches of considerable size. In the apple-trees that were most affected, the limbs an inch in diameter could be snapped right off, when the passages formed by the beetles were found to run in circles, generally spiral, one above the other, with immature *larvæ* or *pupæ* at the end of the furthest chamber, showing that they were breeding in the trees. Over twenty were badly infested, and many others more or less damaged in one orchard examined, and, in some instances, the combined dry season and beetle attacks killed the trees.

When once the beetle has completed his burrows, nothing can save the branch, and plugging the holes up is only protecting it from outside enemies that might find a way in, so that the only check is to spray or cover the bark with some mixture that will not injure the tree, but keep the beetles from touching the bark. Lime, salt, and sulphur wash might be tried, or a similar whitewash brushed over them. All damaged or infested wood should be at once cut out and burnt, or, otherwise, the pest will soon increase.

### *The Furniture Beetle* (Lyctus brunneus, *Stephens*).

This little brown beetle causes a great amount of damage to furniture and other woodwork in the house, and is one of those pests that frequently creates considerable anxiety in the mind of the careful housekeeper when she sees the little piles of dust outside the tiny circular tunnels all over a cherished piece of furniture.

This beetle has been described from England, and in the *Entomologists' Monthly Magazine*, 1876, J. W. Douglass records that "In the year 1862, on a small log of wood with the bark on, imported into London Docks as a sample from Swan River, Western Australia, I found five beetles of a species which had recently been identified as *Lyctus brunneus* by Dr. Sharp. It has also been recorded from France; Montrouzier described it from Woodlark Island, near New Guinea; and Chittenden states that it was found infesting several jars of roots in the Paraguayan exhibits at the Chicago Exhibition; while an undetermined species (which may be identical) infests bamboo work imported from China and Japan.

In the *Canadian Entomologist* (vol. XVIII, p. 154), Dr. Hagon mentions that an allied species (*Lyctus unipunctatus*) infested some supplejack walking-sticks from Jamaica, and in spite of all efforts to eject them, remained for fifteen years, until the lot were "powder posted" (reduced to dust beneath the outer shell) and completely ruined. *Lyctus opaculus* and *L. striatus* sometimes breed in vine stems, and the latter was found in the sap-wood of an oak floor laid in one of the college halls two years before ("Insect Life, vol. IV). This genus *Lyctus* (Family *Cioidae*) contains some twenty described species, many of which are widely distributed, two species of which are common in Australia.

This cosmopolitan beetle has a particular liking for sap-wood in furniture, and where, as is frequently the case in colonial furniture, a strip of sap-wood is left in the seasoned wood, and stained to a uniform colour when made up, within a few months, or maybe a year or more, it will begin to show pin-holes all over the surface, the larvæ having been deposited beneath the bark, and infested the wood before it was cut up and in the drying state. When they are very numerous, they will riddle the infested wood until it becomes a thin shell enclosing a mass of fine dust, which will crumble up between one's fingers. From such infested furniture they sometimes make their way into old seasoned woodwork and furniture, but it does not seem to agree with them, and the damage is confined to a few unsightly holes.

When a new house is built, they often appear in the wainscot boards and woodwork round the doors and windows; but seldom do any permanent damage. They are very serious pests on rattan furniture, and I have known a number of instances where they have completely ruined chairs and tables.

As the wood is generally infested before it is cut up, there is very little chance of getting rid of the pest, as they are working out of harm's way; but on old seasoned furniture a plentiful use of varnish or polishing oil will clear them out. This little beetle is of a uniform reddish brown to almost black colour, slender, and flattened in form, and measuring about 2 lines in length. The upper surface is finely punctured, clothed with buff-coloured hairs which run in parallel lines down the wing-covers. The antennæ are composed of a number of short joints thickly clothed with fine hairs and clubbed at the tip.

### *The Powder-keg Longicorn* (Gracilia pygmæa, *Fab.*).

Some years ago a number of hazel hoops were sent to me with the information that they were all being destroyed by some small grubs, and in consequence the powder-kegs in one of the hulks in the harbour were falling to pieces.

The hoops were burrowed through in every direction beneath the bark and contained numbers of the larvæ and pupæ of a small wood-boring beetle, that bred out in numbers about six weeks after they were received from the powder-hulks.

This beetle, which was unknown to me, was submitted to Mr. Blackburn, of Adelaide, who identified it as the well-known European longicorn beetle, *Gracilia pygmæa,* described by Fabricius over a hundred years ago, and which has become well established in Australia, as Mr. Lea tells me he has taken it in the bush both here and in Tasmania.

This beetle is figured in Spry and Shuckards' *British Coleoptera Delineated,* under the name of *Gracilia minuta.*

It is a small longicorn beetle measuring about 3 lines in length, of a uniform chocolate brown colour, and is found to be clothed with fine hairs when examined under a lens. The head is short, with the antennæ thickened in the basal joint which springs from the centre of the eyes, which are almost divided into two parts. The thorax is rounded, swelling out in the sides, with the legs long, the thighs swollen, the abdomen narrow, with the wing-covers narrowed at the tips.

# Cicadas ("Locusts") and their Habits.

Continued from p. 341.

By W. W. FROGGATT, F.L.S.,
Government Entomologist.

### *The Floury Miller* (Tibicina curvicosta, *Germer*).

A well-known "locust," to the Sydney boys is popularly known as the "Floury Miller," or the "Baker," on account of the rich, silvery pubescence, which makes it look as if it had been dusted with flour. This is composed of very fine, slender hairs, which are curved at the tips.

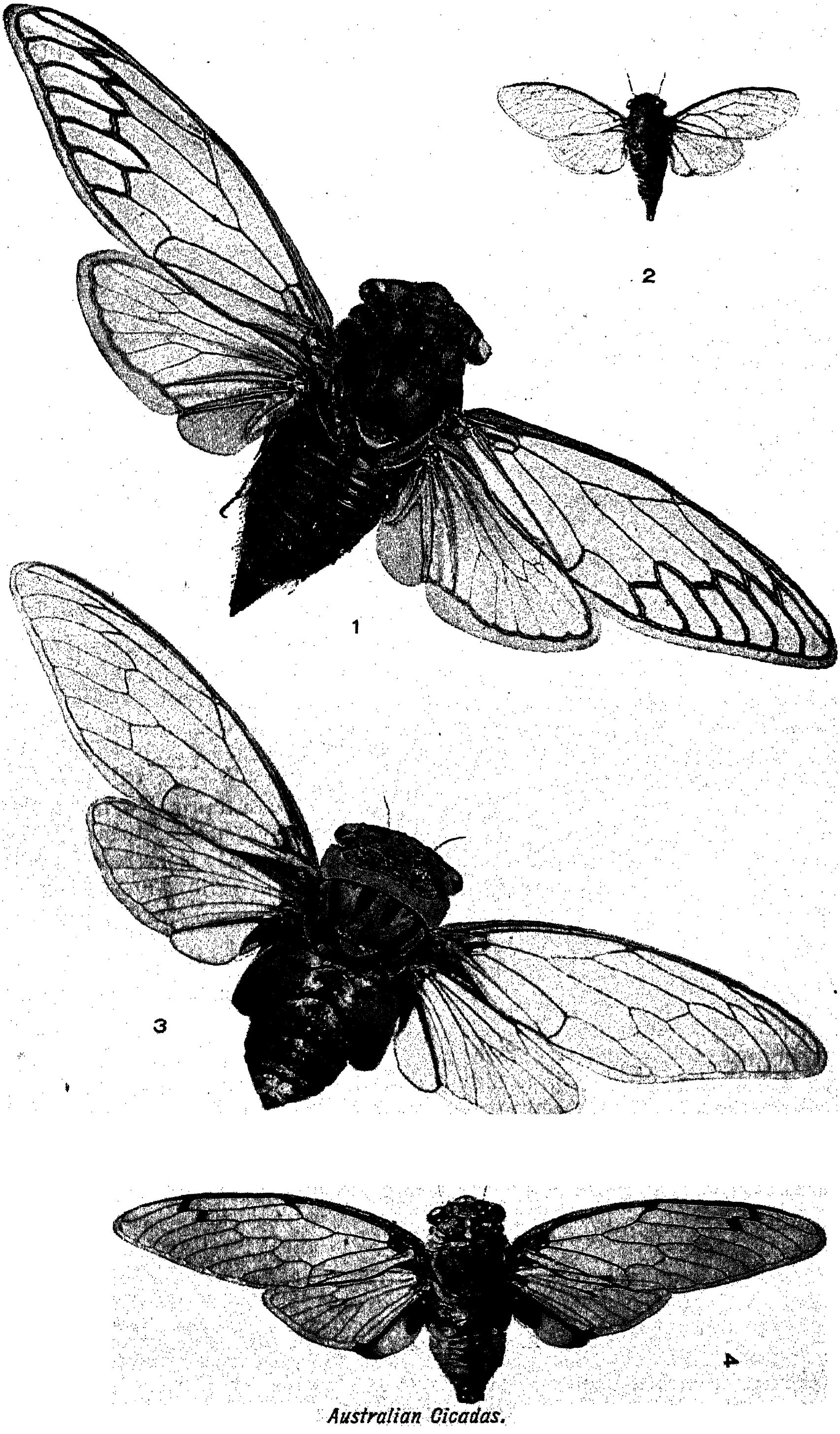
Bennett gives a woodcut of this cicada, highly magnified, in his "Wanderings of a Naturalist."

I am doubtful of its specific name, as I have not seen Germer's original description; but, as it was such a well-known insect among the earlier collectors, it is probably identical. The outspread wings measure just over 4 inches across, and the body hardly 1½ inches in the male. The general colour of the upper surface is chestnut to yellowish-brown, mottled with black; wings transparent, with the nervures brown, and two well-defined black spots near the tip of the forewings. The silvery pubescence is easily rubbed off, but in a freshly-caught specimen is very thick upon the front of the head and abdomen; it is well-scattered all over the insect, even on to the nervures of the wings and over the legs. The Floury Miller first appears early in December, but is more plentiful about New Year, and has a wide range, both in our gardens and in the bush-lands.

### *The Fiddler* (Macrouistria angularis, *Germer*).

This insect takes its popular name from the fancied resemblance of its call-note to the sound of a fiddle. Germer described it under the name of *Cicada angularis;* Walker placed it in the genus *Fidicina,* and redescribed it from New Holland.

It measures slightly over 4½ inches across the outspread wings, and not quite 2 inches from the front of the head to the tip of the abdomen. The general colour is black, with the upper surface of the head and thorax richly-marked with orange-yellow spots and irregular-shaped blotches, with a dull reddish band across the centre, in a line with the forewings. The legs are mottled reddish-brown and black, with the under-surface of the abdominal segments of a somewhat lighter brown. The wings are vitreous, richly-stained with brownish-yellow, with the nervure of a lighter colour, except the costal, which is edged with black; the nervures enclosing the cells along the tip of the forewings edged on either side with dark-brown, giving them a curious, mottled appearance.



*Australian Cicadas.*

1. The Squeaker (*Melampsalta melanophyga*).
2. The Fiddler (*Macrouistria angularis*).
3. The Double Drummer (*Thopha saccata*).
4. The Floury Miller (*Tibicina curvicosta*).

### *The Mottled Grey Cicada* (Psaltoda flavescens, *Distant*).

This insect measures about 4¼ inches across the outspread wings, the body of the male slightly over 1½ inches, and that of the female a quarter less.

The general colour is light-chestnut, regularly mottled with black, finely dusted with a silvery pubescence which is thickest upon the sides of the body. The forelegs are black, with the swollen thighs marbled with gray; the drum-covers very large, flattened, and rich orange colour. The wings are semi-transparent, richly blotched at the base with orange and black; rest of nervures dull yellow, with the cross-nervure marked with black, forming three distinct bands crossing the forewings. This is also a bush species, frequenting the large gum-trees, but is sometimes captured about the gardens. There is nothing very distinctive about its call-note. It was described by Distant.

### *The Squeaker* (Melampsalta melanopygia, *Germer*).

This is a type of a large number of our small cicadas included in this genus, which generally frequent the low scrub and bushes, very active, and flying off at the least alarm, but seldom going into the tops of the high trees. This one appears very early in the season about the Sydney scrubs, and generally rests on the trunk of a large gum-tree when calling. Most of the species have a somewhat similar call-note—four short calls and a squeak—and others sing somewhat like the crickets.

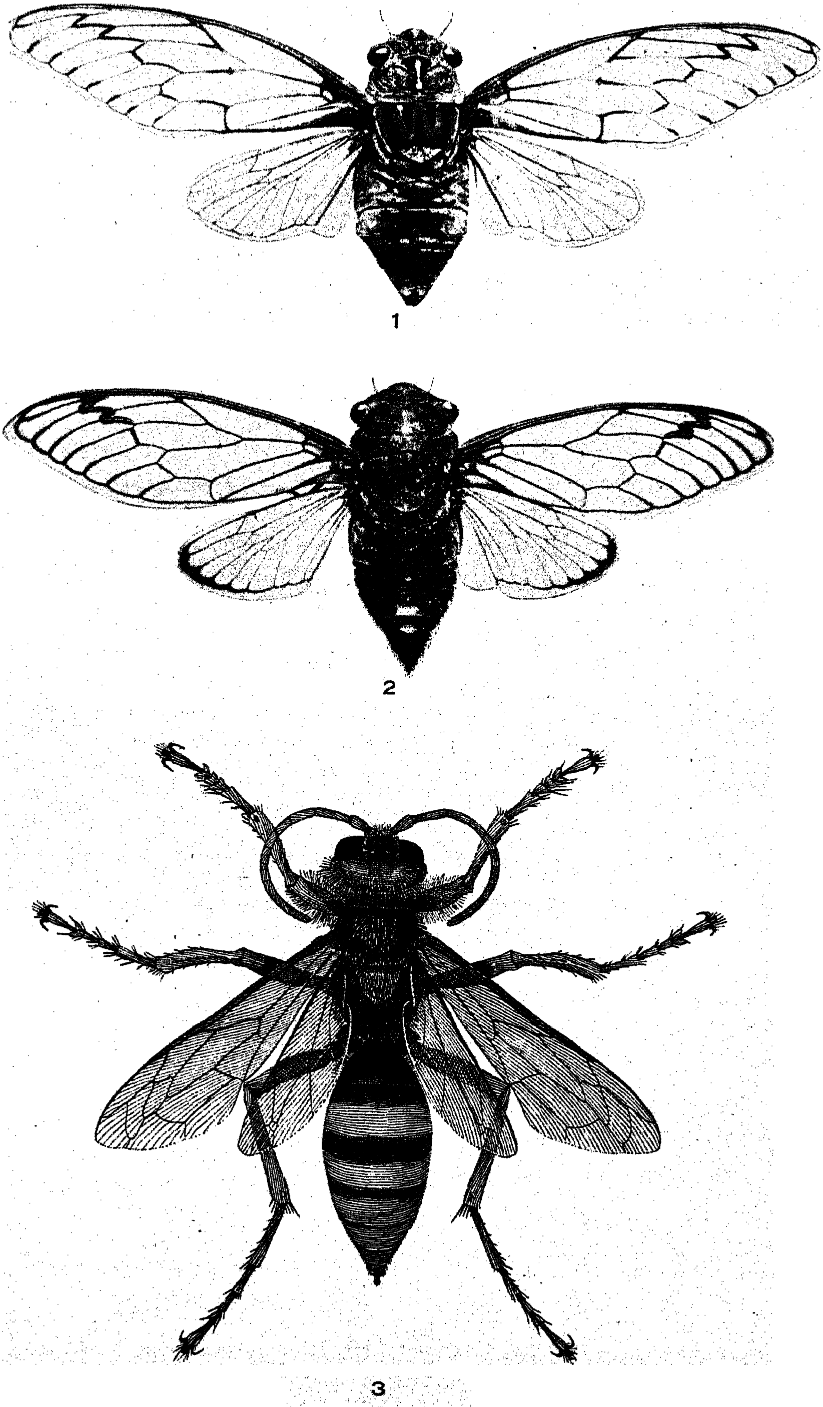
This one measures about 2¼ inches across the outspread wings; the general colour is black, with the under-surface, sides, and tip of abdomen rich orange-yellow, the black forming only a narrow dorsal stripe; the wings are transparent, clouded with yellow at the base, and the nervures dark-brown to black.

### *The Red-winged Squeaker* (Melampsalta encaustica, *Germer*).

This cicada is found about the Shoalhaven and Mittagong districts, and is very similar in its habits; but it differs from the former in having chestnut markings on the head and thorax, the legs richly mottled with red, and the whole of the under-surface of the abdomen bright red on the upper surface; the segmental divisions in the centre of the abdomen and two parallel bands of angular blotches are orange yellow. The wings are transparent, but the costal nervure and the basal portion of the wings rich orange-yellow.

### *The Hairy Cicada* (Tettigarcta tomentosa, *White*).

This curious insect, allied to our true cicadas, was described by Adam White in the "Annals of Natural History, 1846," and was figured in the Appendix "Eyre's Travels in Australia, 1845." His specimens came from Victoria. Mr. Kershaw, the Curator of the National Museum, says they are found in the fern-tree scrubs in Gippsland. My specimen was sent from Tasmania, and it is quite probable that there are two or more species. Mine is larger than all



*Australian Cicadas.*

1. *Psaltoda flavescens.* 2. The Black Cicada (*Psaltoda moerens*).
3. Sand Wasp (*Priocnemis bicolor*), that provisions its nest with living cicadas on which to feed its larvæ.

the Victorian specimens I have seen; but White's description is very brief, and would fit either. General colour, light-brown, mottled with black; expanse of wings, about 3 inches; body measuring 1¼ inches. The head is very small, with the eyes very large and so close together that there is only room for the ocelli to form a triangle between them; the thorax very much transversly corrugated, and the apical portion extending over the base of the wings. The upper surface clothed with very short scattered gray hairs; the under-side clothed with a thick growth of long, downy gray hairs, turning to black round the front of the head. The sides of the thorax project into a sharp spine, and the general form with the wings folded is wedge-shaped.

### *The Green Bladder Cicada* (Cystosoma Saundersii, *Westwood*).

This curious insect was described by Professor Westwood in his "Arcania Entomologica" in 1842, in which he gave a coloured plate of the male, but described it as yellow; his specimen was obtained from Curtis, and the only locality given was New Holland. In the "Proceedings of the Zoological Society, 1852," Scott gives a very interesting account of this insect, with a very fine coloured plate of both sexes. He says that it was very plentiful in an orange orchard at Ash Island, near Newcastle; but it had never been found anywhere else, except a few specimens collected by Sir Thomas Mitchell when exploring in the interior. They appear in September, singing with a loud, deep, guttural R. continued incessantly, with vibrations, and quite different from the shriller, harsher note of the common cicada. They are most active just about twilight, and are very easily captured by shaking the orange-trees in the daytime, when they fall to the ground.

Dr. Bennett, in his "Wanderings of a Naturalist," reproduces these notes, which are again reproduced, with a wood-cut of the male, in "Wood's Insects Abroad," and says it is locally known as the "Orange Locust."

The only locality from which I have received this insect is Glen Innes, where I am told it is not uncommon on the weeping willows early in the summer.

The male has an immense, rounded, swollen abdomen, quite hollow, constricted at the junction with the comparatively small thorax, a pointed head; it measures just under 2 inches in length; the wings, which are opaque green and very leaf-like in structure, only just reaching to the tip of the bloated body; while the female has a small wedge-shaped body, with the wings extending a considerable distance beyond. They are both of a uniform rich bright-green colour, but when dead frequently change to a dull greenish-yellow tint.

### *The Clear-winged Bladder Cicada* (Cystosoma vitripennis, *Westwood*).

This is a much smaller species that was briefly described by Westwood in 1851 in the "Annals and Magazine of Natural History," from M. Verreaux's collection in the Museum Jardin des Plantes, labelled N. Holland.

I captured four or five specimens in October on the Tweed and Richmond rivers, clinging to a small bush plant, which agrees with his description.

They are of a uniform delicate green tint, with clear transparent wings, costal nervure yellow, base tinged with reddish yellow, and other nervures green. The delicate greens also fade into dull yellows unless they are carefully pinned when caught. Male measures 14 lines in length, about the same measurement that Westwood gives in his description.

## BIBLIOGRAPHY.

LIST of papers dealing with Australian *Cicadidae* and consulted in these notes.

(1.) **Amyot, C., and Servelle, A.**

History, Natural. *Hemiptera*, p. 471-372, 1843.

This work contains descriptions of some Australian species, but has not been seen by the writer.

(2.) **Amyot, C.**

*Annals Société Entomologique de France*, 1845-47. *Entomologie Francaise, Rynchotes*, p. 143.

A classification of the *Homoptera.*

(3.) **Bennett, G.**

Wanderings of a Naturalist, 1860.

Notes upon *Cystosoma Saundersi*, and other descriptions of the noise made by *Cicadas* in New South Wales.

(4.) **Buckton, G. B.**

Monograph of the British *Cicadidae*, vol. I, 1890.

The author gives a great deal of interesting information about *cicadas* and the derivation of the name.

(5.) **Boisduval.**

*Voyage de l'Astrolabe*, Zoology, 1832. *Hemiptera*, pp. 610–13.

Describes two species from the neighbourhood of Sydney—*Cicada teprogaster*, and *C. dechroa*, pl. 10, figs. 5, 7.

(6.) **Distant, W. L.**

Transactions of the Entomological Society, London, p. 644, 1881.

Describes *Psaltoda aurora* from Rockhampton, Q.

(7.) **Distant, W. L.**

On some undescribed *Cicadidacae* from the Australasian and Pacific regions. Proceedings of the Zoological Society, p. 126, pl. 7, figs. I–II, 1882.

Thirteen new species from Australia are described and figured.

(8.) **Distant, W. L.**

Monograph of Oriental *Cicadidae*, 1891–2, pts. I–VII, pp. 1–158, pl. I–XV.

Notes on some Australian species, but none from here described.

(9.) **Distant, W. L.**

*Annals Société Entomologique Belgique.* XXXVII, p. 79, 1893. On Australian species (*Melampsalta denisona*) described from Queensland.

**(10.) Distant, W. L.**

On some undescribed *Cicadidae*, with synonymical notes.
Annals and Magazine of Natural History. Vol. IX (ser. 6), p. 313, 1892.
Describes a number of new Species from Australia, Africa, and India.

**(11.) Contributions to the knowledge of the Rynchota.**

Transactions of the Entomological Society of London, p. 591, pl. xvii, fig. 1, 1901.
Figures and describes *Cicada sylvana* from Cairns, Q.

**(12.) Donovan.**

Insects of New Holland, 1805. *Hemiptera.*
Describes eight species, and figures the yellow variety of *Cyclochila australasiæ*.

**(13.) Erichson, W. F.**

*Beitrug zur Insekten-Fauna von Van Dieman's Land, mit besonderer Berucksichtigung der geographischen Verbritung der Insecten*, 2 pl. *Archiv. f. Naturgesch. Jahrg.*, 1842.
A summary of this paper is given in The Transactions of the Royal Society of Tasmania, vol. III, 1855-59, p. 298.

**(14.) Etheridge, R., and Olliff, A. S.**

Memoirs Geological Survey of N. S. Wales, 1890. Palæontology, No. 7, pl. 1, fig. 1.
Describes a fossil species under the name of *Cicada Lowei* from N. S. Wales.

**(15.) Froggatt, W. W.**

Notes on *Cicadas*.
Proceedings of the Linnean Society, N.S.W. Vol. X, p. 526, 1895.
A general account of some of the common species found in New South Wales.

**(16.) Germer, E. F.**

Silbermann's *Revue Entomologique*. Vol. II, p. 49, 1834.
A number of Australian species described.

**(17.) Germer, E. F.**

*Species Cicadarum enumeratæ et sub genera distributæ.*
Thon's Entom. Arch. Bd. 2, heft 2, pp. 37-57, 1834.

**(18.) Haswell, W. A.**

On the vocal organs of the *Cicada*.
Proceedings of the Linnean Society of N. S. Wales. Vol. 1 (ser. 2), p. 48, 1886.
General account of the mechanism of the drums, based upon Morgan's paper in Nature.

**(19.) Kershaw, J. A.**

Notes on the great abundance of the Black *Cicada* and other species in the Dandenong, Victoria.
The Victorian Naturalist. Vol. XIII, p. 119, 1897.

**(20.) Kirby and Spence.**

Introduction to Entomology. Vol. II, p. 402, 1816.
On the musical sounds of *Cicadas*.

**(21.) Leach, W. E.**

Zoological Miscellanies. Vol. I, p. 89, 1814.
Two species—*Cicada marginata* and *C. Harrisii*—figured and described.

**(22.) Lucas, A. H. S.**

On the sound organs of the Green *Cicada*.
Transactions of the Royal Society of Victoria. XXIII, p. 173, pl. 1, 1887.
An account of the experiments and examination of the musical apparatus, with notes on Morgan and Reaumer's work.

(23) **Marlatt, C. L.**

The Periodical *Cicada.*
Bulletin No. 14 (new series). U. S. Department of Agriculture, Division of Entomology, 1898.
A complete account of the 17-year-old *Cicada* in the United States, with many illustrations.

(24.) **McCoy, F.**

Podromus of Zoology of Victoria. Decade V, p. 53, pl. 50, 1880.
A general account of the two common species of Victoria—*Cicada moevens*, and *Cyclocila australasiæ.*

(25.) **Morgan, Lloyd C.**

On the sound-producing apparatus of the *Cicada.*
Nature, 18th February, p. 368, 1886 (with wood-cut).
The author refers to a previous paper in the Pro. Philo. Society of S. Africa, 1879–1880 (Notes on the Sangerjie), and gives an explanation of the sound organs.

(26.) **Reaumer.**

*Mem. pour l'Histoire des Insectes.* Vol. V, p. 158, 1740.
In this paper the original correct description of the sound-producing organs is given.

(27.) **Riley, C. V.**

First Annual Report of the Noxious, Beneficial, and other insects of Missouri, 1869.
A general account of the 17-year-old *Cicada.*

(28.) **Scott, A. W.**

On *Cystosoma Saundersii*, Westw.
Proceedings of the Zoological Society. XX, p. 14, pl. 1, 1852. Also reprinted in the Annals of Natural History (ser. 2). Vol. 13, p. 336, 1854.

(29.) **Solier.**

*Observations sur quelques particularites de la stridulation des Insectes et en particulier sur le chant de la cigale.*
*Annals Société Entomologique de France.* Vol. VI, p. 199, 1837.

(30.) **Walker, F.**

*Homoptera.* Pts. 1–2, 1850–1, British Museum Catalogue.
A list of all the species in the British Museum, with description of a number of Australian species.

(31.) **Westwood, J. O.**

*Arcania Entomologica.* Vol. I, p. 92, pl. 24, fig. 1.
The original description of the Green Bladder *Cicada, Cystosoma Saundersii.*

**White, A.**

Description of some apparently new species of Homopterous Insects in the Collections of the British Museum.
Annals of Natural History. Vol. 17, p. 330. 1846.
Describes *Tettigarcta tomentosa.*

**Wood, J. G.**

Insects Abroad (new edit.), 1883, p. 732.
Describes and figures the Green Bladder *Cicada,* and quotes Messrs. Scott and Bennett's notes.

# Government Assistance to Dairying and other branches of Agriculture in other Countries.

M. A. O'CALLAGHAN.

## DEPARTMENTAL WORK IN IRELAND.

I HAVE just received a copy of the Second Annual General Report of The Department of Agriculture for Ireland, and some of the matter contained therein, particularly that referring to the schemes drawn up for the improvement of the dairying industry in general, and the breeding of live stock in particular, is of special interest to the dairy farmers of this State. The main object of the scheme is to improve the dairy and store cattle in Ireland, by encouraging the breeding or introduction of pure-bred bulls of a high degree of excellence, and by inducing associations of persons of means to purchase high-class bulls for the use of small farmers. It is also intended to encourage small farmers to retain their best heifers for breeding purposes by offering prizes at local shows.

The Department endeavours to bring this scheme to a successful issue in several ways. They do not seem to possess a stud farm as does this State, nor do they seem to have purchased many bulls for leasing purposes, their main effort being directed towards granting premiums to approved animals which are to be utilised for public service at very low rates. The following clauses give details of this part of the scheme:—

> In the absence of any special circumstances the joint fund available under this scheme for encouraging improvement in the breeds of cattle may, after the expenses of administration are provided for, be apportioned as follows:—(1) at least 60 per cent. should be given in premiums to bulls, and (2) the remainder in prizes to be administered in accordance with the regulations of clause 13, section II, of the Department's scheme for assisting county and local shows.
>
> Under exceptional circumstances the Department may provide for a county as far as funds will permit, and under certain conditions to be prescribed by them, in one of the following ways, viz.:—(1) by assisting approved applicants of small means, whether individuals or associations, to buy suitable bulls under the Department's scheme of loans for purchase of bulls; (2) by providing a loan for a short period to enable a representative, appointed by a county committee, and an inspector of the Department, to import suitable bulls into the county on behalf of approved applicants; (3) by purchasing, in very exceptional cases, bulls for certain districts.
>
> Only bulls entered in, or eligible for entry in, the herd-books of their respective breeds shall be selected for premiums. Owners of bulls not entered must produce a certificate from the secretary of the herd-book to the effect that the bull is eligible for entry, and will duly appear in the next volume.
>
> Preference shall be given to yearling bulls, which must have been calved between the 1st September, 1900, and the 1st May, 1901.
>
> The amount of a premium for a high-class yearling bull shall be £15, payable, subject to the regulations of this scheme, at the close of the season.
>
> In the event of there not being a sufficient number of high-class yearling bulls for the purposes of this scheme, two-year-old bulls, which received premiums as yearlings under the Department's scheme for 1901, shall, provided the Department's inspectors are satisfied of their entire fitness therefor, be eligible in 1902 for a premium of £15.

Yearling bulls shall be selected mainly at principal spring shows and sales, the secretaries or managers of which have applied for, and have received, recognition by the Department for this purpose before the 1st January each year.

(1.) A list of approved bull shows and sales will be forwarded by the Department to the secretary of the county committee as soon as possible after the 1st January, 1902. (2.) The secretary shall thereupon, by means of advertisements in the local papers or by posters, invite applications from persons who intend to compete for a premium, and to have their bulls selected at one or other of these shows or sales. Such applications must be made on the form to be supplied by the secretary.

### *Selection of Premium Bulls.*

The county committee shall appoint a judge (who shall be a non-resident in the county) to select bulls for premiums, along with the Department's inspector, and the selection of the judge and the Department's inspector shall be final.

In the event of the judge appointed by the county committee being absent for any reason, the Department's inspector shall judge alone, and his selection shall be final.

No person shall possess two premium bulls of the same breed, unless located at least three miles from each other.

Each premium yearling bull shall serve not less than thirty cows, and each two-year-old not less than fifty cows, other than those that are the property of the owner of the bull. The service fee for the number of cows stated shall in all cases be 1s., inclusive of all charges. After the maximum number of cows have been served the owner may fix such fee as he may desire.

The county committee may make such provision as they think necessary with regard to the maximum number of cows which may be served during the season.

The owners of premium bulls shall forward to the secretary of the county committee a form containing a return of the names, addresses, and valuations of the persons whose cows have been served by the premium bulls, at the fee named in clause 26, together with a statutory declaration, signed before a magistrate other than the owner of the bull, certifying that the said cows have been served, and that all the regulations of this scheme have been complied with.

### *Conditions under which Loans will be made to Farmers to enable them to purchase Bulls.*

No application for a loan for the purchase of a bull will be considered if coming from a locality in which, in the opinion of the Department, there is already a sufficient number of pure-bred bulls for the purpose of their scheme.

The applicant for a loan must satisfy the Department as to the necessity for obtaining a loan.

No loan will be made save for the purchase of a pure-bred yearling bull, passed by the Department's inspector as suitable for a premium. The bull must be of a breed approved by the county committee of agriculture and technical instruction.

The purchase price of the bull must be approved of by the Department.

Applicants for loans for the purchase of bulls must be made direct to the Department at least four weeks before the date fixed for the spring show or sale.

Before taking possession of the bull, the applicant must pay to the Department's representative at the sale or show where the purchase is made—(1) one-third of the approved purchase price: (2) the stamp duty; and (3) the charge for insurance. Further, he must sign a form of undertaking to have the necessary form of guarantee for repayment duly signed and completed.

As soon thereafter as possible, the approved applicant and two approved solvent sureties shall sign a form of guarantee to repay to the Department the amount which will be advanced by them, viz.:—Two-thirds of the purchase price, in two equal annual instalments, at the end of one and two years respectively, from the date of payment to the vendor by the Department, together with interest at the rate of 2½ per cent. on the outstanding balance.

In the case of an association, the person in whose charge the bull is to be placed must, with two other approved members of the association, in their capacity of private individuals, guarantee repayment of the loan.

Each bull purchased under this scheme must be insured by the applicant for a loan for the full amount of the purchase price.

The charges for insurance shall be 5 per cent. on the full purchase price. This charge must be paid to the Department, who will, subject to all the regulations of this scheme being complied with, insure the bull as from the date of payment of such charge until the loan has been repaid; but in no case will the insurance cover a period longer than two years from date of payment of this charge.

(1.) He must give notice in writing to the Department within twelve hours of the commencement of any illness or lameness of the bull. Like notice must also be given (*a*) in the event of any accident or injury occurring to the bull, and (*b*) in case of the death of the bull.

(2.) He must take all reasonable precautions to prevent the bull from coming into contact with any animal suffering from disease.

(3.) He must provide proper accommodation for the bull, and care for him in a proper manner, to the satisfaction of the Department's inspectors.

(4.) He must procure at his own expense the services of a veterinary surgeon when necessary.

The non-observance of any one of the conditions of this scheme will render the insurance void, and all moneys paid therefor will be forfeited to the Department.

The Department shall have the right to inspect the bull at any time, and to remove him at any time, if it is found, in the opinion of the Department's inspectors, that he is not being properly cared for, or in the event of an instalment of principal and interest being in arrear for more than four weeks.

The Department reserve the right to brand or mark premium bulls, and to inspect them from time to time.

The Department also reserve the right to apply the tuberculin test, at their own expense, to any premium bull.

The bull shall remain the property of the Department until all instalments of principal and interest are paid off.

With reference to these schemes for the improvement of live stock, the Vice-President of the Department gives, in his Annual Report regarding Cattle-breeding, some interesting information. It appears that a sum of £4,039 was paid away as premiums to the owners of selected pure-bred bulls under the conditions above referred to. In all, 350 premiums were awarded, 200 of which were given to yearling and 150 to two-year-old bulls. A considerably larger number of premiums were offered, but, owing to various causes, the total number were not applied for, one of the chief causes being that the Royal Dublin Society has also a scheme for granting premiums to yearling bulls, and, in 1901, 169 such premiums were granted at £15 per head. During 1902 the Royal Dublin Society offered 259 premiums of £15 each for yearling bulls, and, besides this, it is expected that a very much larger number of premiums offered by the Department of Agriculture will have been taken up in 1902, as compared with 1901. The Vice-President attributes the cause of the increase as follows:—"This increase is mainly due to the fact that the schemes were better understood; that the value of premiums for yearlings were increased, and that the restrictions on the importations of animals in Great Britain were relaxed." It is thus seen that there was a sort of competitive scheme being run by the Royal Dublin Society and the Department of Agriculture. This was due to the fact that the Royal Dublin Society's scheme was in vogue before a Department of Agriculture was granted to Ireland. In future this clashing of schemes will cease, for an arrangement has been come to whereby the Royal Dublin Society will hand over the money that was placed at their disposal for the granting of these premiums to the Department of Agriculture, who will in future administer such funds in connection with their own schemes. The action of the Royal Dublin Society in coming to this praiseworthy and common-sense decision shows that the interests of their country are considered before the interests of their society, and herein lies a lesson for many agricultural societies.

The Vice-President of the Department refers as follows to this cattle scheme: "One of the objects of the scheme is the encouragement of breeding in Ireland of high-class pure-bred bulls. The influence of the scheme in this direction is already being felt, for there has been started in Ireland during last year quite a number of herds of pure-bred cattle, which, it is hoped, will in time supply the needs of Ireland, and replace the inferior bulls that are usually kept in certain districts, much to the detriment of the store-stock trade and to the dairying industry of Ireland." The idea of insuring the bulls purchased by loan money is an excellent one, but the premiums charged by insurance companies for this class of business are usually very high, and it appears 7 per cent. per annum was what was demanded by the insurance companies for this work. The Department stepped into the breach and offered to do it themselves, or rather to assume the liability for a premium of 2½ per cent. per annum for the two years until the loan has been discharged. Referring to this matter, the Vice-President states: "This change has induced many farmers of small means to take advantaga of the loan scheme to purchase high-class bulls. Unfortunately, however, it is doubtful whether farmers of very limited means are able to properly feed and house such high-class animals in a manner that they may be of the most value to their neighbours;" and he suggests that in future the animals should be located with farmers whose conveniences are such that the bull may receive full justice, the animals being for the use of the small farmers can be utilised for that purpose when the animal is stationed on the premises of a large farmer, as well, if not better, than when stationed at the premises of a small farmer.

The horse-improvement scheme is somewhat similar to the cattle-improvement scheme, and in 1902, 111 thoroughbred and 51 agricultural stallions were registered; these figures being an increase of 14 and 20 respectively, as compared with those of the first year. During the months of March and April 170 Mare Exhibitions were held, in connection with which a total of 2,517 nominations were awarded, viz., 1,118 at £2, 84 at £2 10s., and 1,245 at £3.

The chief drawback to the complete success of the 1902 scheme was the lack in certain counties of stallions suitable for registration. An attempt was made to overcome this difficulty by giving premiums varying from £50 to £125 to the owners of registered stallions who were prepared to locate or travel sires in districts where there was an insufficient number. In all nine such premiums were provided.

With regard to pigs and sheep, it was found that these schemes did not work nearly so successfully with regard to the breeding of pigs as it did with regard to horses and cattle; and with regard to sheep-breeding in particular, the scheme was found to have so many difficulties as to make it almost impracticable, and in future the money devoted to this purpose for sheep-breeding will be given in prizes to sheep at local shows instead of awarding premiums.

The reader who has carefully digested the foregoing will no doubt wonder whether any portion of these schemes might be applied with success to the improvement of the live stock in this State. It will be remembered that the Agricultural Department imported a considerable number of cattle about four years ago with a view to utilising them for the purpose of improving our dairy herds.

The cows were placed on a stud farm which is now situated near Berry, and the greater number of the bulls were leased to agricultural societies with a view to making their services available to the dairy farmers in those districts. Such a scheme must to a great extent depend for its success on the attention bestowed on the matter by the agricultural societies to whom the animals were leased. In some cases excellent results, due to proper management, were achieved, but in many other instances the animals were not properly utilised, owing in a great measure in their being stationed at centres too remote from the greater number of dairy farmers. To have such a scheme carried out with the highest degree of success the centres at which the bulls are stationed should be altered about every three months. In this way all the farmers of the district would have an opportunity of utilising the animal's services. As this was not carried into effect the Department very wisely adopted the practice of leasing these bulls direct to desirable farmers for periods of three and six months with the proviso that the bull should be available for the neighbouring farmers under certain conditions as to fees. Progress associations and dairy associations, as separate from agricultural societies, were also included in the scheme, and such bodies may now lease imported bulls, or the progeny of these imported bulls and imported cows, from this Department; and these opportunities are fully availed of. Unfortunately, however, the number of animals falls far short of the approved applications of the farmers for same. This is a matter that may be improved by increasing the number of bulls available, especially animals of those breeds most sought after. While on the question of breed it might be well to point out that the Department imported in all representatives of eight dairy breeds, viz., Shorthorn, Holstein, Red Poll, Guernsey, Jersey, Ayrshire, Kerry, and Dexter-Kerry. Shorthorns and Guernsey, are generally speaking the most popular, but there is also a good inquiry for the other breeds. The progeny of these bulls from the cows of our farmers are much sought after, and fetch higher prices than animals bred in the ordinary way. They have also of late entered into competition in our agricultural shows, but necessarily only in the younger classes in which they have met with considerable success. It will be remembered that when these cattle were imported they were subjected to a considerable amount of criticism, a great portion of which was prejudiced, and consequently adverse. A reaction has, however, set in, and now that the progeny of these cattle have been before the public they are thought more highly of, and the very best breeders in the State have leased, and continue to apply for the services of these animals.

Another means by which new blood has been introduced into our dairy herds through this importation has been the selling of young animals bred on the stud farm to our dairy farmers. Many years must elapse before the number of bulls desired by our farmers could be placed at their disposal by this Department, and the question arises whether some portions of the live-stock scheme above referred to, may not be worthy of consideration. The question of granting loans for the purchase of young bulls by our farmers does not seem to commend itself. Preferable is the system of granting annual premiums to suitable young animals. Special prizes are given in the dairy sections to various agricultural societies, and the introduction of this scheme might be worthy of Ministerial consideration. No doubt it would stimulate the breeding of pure-bred animals with the idea of producing young bulls worthy of competing for these premiums, and in this way an impetus will be given to the improvement of our dairy cattle. On the other hand, with the exception of two breeds—Ayrshires and Jerseys—considerable difficulty would be experienced in finding many pure-bred animals worthy of a premium. However, some of our largest farmers might be induced to import other breeds if they were assured that such premiums would be continuous.

Another point, which is calculated to make this premium scheme of less value in Australia than in Ireland, is that our dairy farmers have larger areas than in that country, and, consequently, keep more cows. Almost every farmer here has a bull of his own, and, I fear, would not be disposed to send cows for service to his neighbour's bull, even though he was a much better animal. Still cattle-breeding from the dairy point of view is improving very rapidly, and farmers who were previously satisfied with mongrel sires will now have nothing but pure-bred animals descended from a milking strain.

Towards bringing about this improvement and desire for improvement the work of this Department has been considerable. The main point, however, to bear in view is that we are very far away from perfection; and there are years and years of hard work ahead before the dairy cattle of this State will have reached the high standard of production which is desirable in the interests of an industry which is open to the world's competition.

## SUBSIDY TO AGRICULTURAL SOCIETIES.

THIS is a question on which there is an annual crop of criticism in this State, and during the show period proper one can hear the merits and demerits of agricultural societies and shows discussed in almost every provincial town in the State. About a month ago, I was having breakfast in an hotel situated 10 miles from a town in which an agricultural show was in progress. The show and the farmers were discussed in detail by some of those present at the table, and one gentleman whose business arrangements had evidently been slightly upset owing to the show being in progress held forth pretty freely on agricultural shows and agricultural people. He seemed to have nothing but contempt for our dairy farmers, and for our agricultural shows, nothing but the wild criticism of the ignorant. He stated that our farmers were too lazy to work, and that the shows were only excuses to a great many to have an annual "booze." At this time the hands of the clock pointed towards 9 a.m., and the farmers' critic seemed rather surprised when I informed him that, as a rule, most farmers had by now done what he would consider a hard day's work, that instead of sitting down quietly to their breakfast they were by now earning their dinner, and that in all probability they were up and about at 5 in the morning when this gentleman was enjoying a quiet slumber. This is only one instance of unjust and ignorant criticism by people who do not consider farmers as being in as good a sphere as the small workers in commercial houses. The position of the farmer is daily improving in all civilised countries, and it is only a question of time when the study of agriculture will rank with the study of medicine, law, &c., in our universities. As regards this point it is worthy of note that, as long ago as 1630, agriculture was in Hungary a subject of university rank, and to-day Hungary holds a position in agriculture unequalled by most other countries. The land under cultivation in Hungary last year amounted to 76,058,384 acres, and almost all branches of agriculture are carried on there with success.

Coming back to the question of Agricultural Shows, the Vice-President of the Irish Department of Agriculture states in his report, "There can be no doubt as to the value of local shows in encouraging the improvement of stock in a district. The Department's inspectors report that in some parts of Ireland where shows have been held for many years their influence on the stock of the district is clearly evident when compared with the best stock of districts in which shows are of recent formation."

I think the same might be said with regard to the stock in various districts throughout this State. Shows must stimulate local effort, and this effort is renewed yearly, so that in time considerable improvement must take place in the direction in which these efforts have been sustained. It is questionable as to whether there may not be too many shows. That is another matter altogether, and does not affect the principle of agricultural shows which is, when properly carried out, one of education, stimulation, and improvement.

With regard to the system of subsidising these agricultural shows, it is noted that the Irish Department of Agriculture does not make, as a general rule, direct grants to the societies, but limit their donations to the granting of prizes in which they consider desirable.

The following are some of the clauses in the schemes drawn up by that Department for the improvement of Irish live stock :—

> A portion of the joint fund available in any county under the Department's schemes for encouraging improvement in the breeds of live stock may be offered in prizes for live stock, at shows held by agricultural societies in the county or in an adjoining county.
>
> Where no agricultural society exists the Department, on conditions to be prescribed by them, may approve of a special exhibition being organised by the county committee expressly for the purpose of awarding such prizes.
>
> No grant other than that given for special prizes under this scheme, shall be made either from the rates or from the funds at the disposal of the Department for the purpose of awarding prizes for live stock, and no portion of any grant shall be used for the purpose of defraying any part of the expenses of the show. The joint contribution from the rates and from the Department to agricultural societies in respect of live stock, shall take the form of prizes to be offered for classes specified in class 13 of this scheme.

The proportion of the joint fund available for prizes to be offered under this scheme at a show held by an established agricultural society will depend upon :—

(1.) The number of existing shows in the county;
(2.) The efficiency with which the show was conducted in 1901;
(3.) The amount of the local subscriptions to the funds of the society received during the last three years.

No established society shall be eligible to receive a share of the joint fund available under this scheme, which does not supply the Department, through the secretary of the county committee, with the following particulars :—

(1.) A copy of the rules of the society;
(2.) A copy of the prize list for 1901;
(3.) A list of the local subscriptions actually received in 1901;
(4.) A copy of the last audited balance-sheet;
(5.) A complete copy of the proposed schedule of prizes for the approval of the Department before publication, and at least six weeks before the date of the show. The classes for prizes offered under this scheme must appear in a special section of the prize schedule and of the catalogue under the heading specified for each county :—

### *Appointment of Judges.*

The award of prizes at shows in the classes subsidised by the county committee and the Department may be made by the judges appointed by the agricultural society. In the case of local exhibitions, the county committee shall appoint a judge, who must be non-resident in the county, with whom the Department's inspector shall act in awarding prizes.

### *Privileges of the Department's Inspectors.*

The Department's inspectors shall have the right to enter the ring during adjudication in the classes subsidised by the Department and the county committee.

Prizes are offered under this scheme for horses, cattle, sheep, pigs, &c. The classes in the horse section are of the general kind; but class 4 strikes us as being very serviceable one, and it is to be noted that the Department states that at least one-half of the money available for horse-prizes must be given to this class, which reads as follows :— .

Class.—Prizes and premiums for young mares from 3 to 6 years old suitable for breeding purposes, payment to be withheld until certificate of service in 1902 by a sire on Department's register for 1902 was produced.

With regard to cattle, it is noted that prizes are given for pure-bred bulls only, half-bred animals being evidently in disfavour with the Department, the same might be said regarding the prizes given for male sheep and pigs. With regard to the females, no such stipulation is, however, made. It would be rather a good thing if somewhat similar stipulations were made regarding subsidy granted to agricultural societies in this State in the live-stock classes, and more particularly with regard to dairy cattle. The prizes and premiums it is stated may be withheld where there is insufficient merit, and in all cases of dispute in connection with the scheme the decision of the Department is to be final.

Besides the fact that neither prizes or premiums are given for cross-bred bulls, two other clauses in connection with the granting of subsidy are worthy of note; these are the clauses referring to the appointment of judges, and to the privileges of the Department's inspectors. The Department is evidently satisfied to allow the judges nominated by the old existing agricultural societies to say which animals are to receive prizes and premiums; but in the case of local exhibitions, the Department reserves the right to have one of their inspectors assist one other judge in arriving at the decisions, and it also stipulates that the other judge shall not be a resident in the county in which the show is being held. This latter is a very useful precaution, and one that ought to be generally carried out by all societies, because no matter how capable and how honest a local judge may be, the public are apt to make criticisms which interfere with the educational value of the judge's services, by suggesting that his decisions are not unprejudiced.

The clause which makes reference to the privilege of the Department's inspectors is evidently put there, so that an officer of the Department who may be a very good judge of the class that is being adjudicated on may be able to report on the correctness of the awards. His presence there may also be of considerable use to his Department, as for instance, in the selection of animals which he may consider suitable for or worthy of premiums at a future date.

## ITINERANT INSTRUCTION IN AGRICULTURE AND DAIRYING:

THE following particulars are taken from the report of year 1901–1902. —A decided advance has been made in putting into effect the system of agricultural instruction adopted by the Department. This system aims at providing in each county one or more instructors in agriculture, poultry-keeping, bee-keeping, dairying, and cognate subjects to be followed in due course by county schools of agriculture. The main hindrance to rapid progress has been the want of properly-qualified instructors. To meet this need a special short course of instruction was held at the Albert Institute during the summer of 1901, with the result that the Department secured the services of a few young men and women to act as county lecturers.

Generally the procedure adopted by these counties was the arrangement for a number of lectures in the winter evenings, to be followed in spring, in the case of agricultural instruction, by a series of field experiments and demonstrations, and, in the case of poultry-keeping, by the establishment, in a few instances, of farms for the distribution of settings of eggs of pure breeds of fowls. In the majority of cases the Department paid the whole salary of the agricultural instructor, the county committee defraying the expenses of locomotion. All other expenditure in connection with this work was borne equally by the Department and the county concerned, except in partially congested counties where the Department contributed five-ninths of the cost.

During the past year about 700 lectures were delivered by the agricultural instructors, the attendance averaging about 100 per lecture; in some instances the audience numbered close on 200. These lectures were followed by discussions, in which the farmers present gave their experiences, and asked questions relating to their business.

In addition to delivering lectures the instructors, as time permitted, visited a large number of individual farms, and arranged upwards of 150 experiments, as well as about 300 demonstration plots with varieties of seeds and manures.

The work of an itinerant instructor does not, however, cease with the delivery of lectures and the arrangement of experiments and demonstrations. It is his duty to advise farmers, either during visits of inspection to their farms, or by letter, on such technical questions as they have not had facilities for studying.

It is also his duty to explain the schemes of the Department, to distribute leaflets, to collect samples of seeds and manures of doubtful quality for the information of the Department, to report generally on the condition of agriculture in the county to which he is accredited, and to suggest means for its improvement.

### *Instruction in Butter-making.*

With reference to itinerant instruction in dairying, the following clauses are taken from the scheme put forward for carrying into effect the desires of the Department:—

1. The Department are prepared, provided qualified instructors can be obtained, to approve of the appointment of an instructor in butter-making in each county.
2. The Department will, as far as possible, assist the county committee in obtaining an instructor by supplying the names of persons qualified for the post.
3. It will be the duty of the county committee to select suitable centres at which classes will be held, and to appoint at each centre an honorary secretary, and a committee who will be responsible for the local arrangements necessary for the proper carrying out of the work, and who will be required to comply with the annexed conditions.
4. The instruction will take the form of daily lessons on dairying accompanied by practical instruction in butter-making, each course should extend for a period of not less than two and not more than four weeks. Not more than twelve pupils should be admitted to each class. Pupils must undertake to attend regularly.
5. On the first day of visiting each centre the instructor should give a public lecture and demonstration, and during the remainder of the course of that centre should conduct a class daily in which pupils only will take part, but which shall be open to the public.
6. The Department are prepared to pay 50 per cent. of the actual cost of this scheme provided (1) that they can approve of the estimated total expenditure; (2) that the scheme is carried out to their satisfaction; and (3) that they are furnished by the secretary of the county committee with a separate account of the cost of each class.

Besides these county instructors in dairying there are attached to the staff of the Department competent dairy experts or instructors who give advice and instruction to factories and farmers.

### *Instructors in other Branches of Agriculture.*

Itinerary instructors for each county in agriculture proper are also provided for in a scheme similar to the foregoing one for dairying.

An instructor in poultry-keeping for each county can also be procured under a somewhat similar scheme.

### *The work of Inspectors attached to the Dairy Division.*

Not the least important portion of the work performed by the Irish Department is that which has been done by the special inspectors, or what might be termed "the watch-dogs of the Department." Among the numerous duties of these inspectors are: the watching in transit to market of all Irish produce—cattle, butter, fish, &c.; the taking of samples of dairy produce for purposes of analysis, so as to keep the local authority who administer the Foods and Drugs Act (1899) up to the mark. The Departmental inspector under this Act, in 1901, took for analysis 318 samples of butter and margarine. Twenty prosecutions resulted and eighteen convictions were obtained. In addition, the local authorities, in 1901, had analysed 866 samples of butter, 46 of margarine, 23 of cheese, 2 of margarine cheese, and 2,679 samples of milk. This shows how the Department of Agriculture safeguards the Irish dairy industry from the point of view of adulteration and misrepresentation. With regard to transit arrangements, considerable improvements have taken place. Refrigerated waggons are now placed on the principal railways for the transit of butter in summer, and though the trip from Ireland to England is but a short one the principal steamship companies have recently fitted up refrigerated rooms for the transit of butter. These are two steps of advancement which will help to place Irish butter at the head of English quotations, and it is not surprising to read in the London Report, of 31st January, 1903, that Irish creamery butter is quoted a little higher than Danish. The quotations are interesting, and are as follows:—Danish (finest), 106s. to 108s. per cwt.; Irish creamery, 106s. to 110s. per cwt.; Normandy, 84s. to 104s.; Canadian, 84s. to 94s.; New Zealand, 94s. to 104s.; Russian, 88s. to 96s. From these quotations it may be seen that Russian butter will compete with second-class New Zealand butter. This means that the making of second-class butter in Australia and New Zealand will become less and less profitable from an export point of view, and this is the feature of our dairying that I would ask our dairy farmers and manufacturers to seriously consider. The world's competition is becoming keener and keener, and when good seasons return Australian dairy produce will have to face that competition. The question we have now to consider is—Will our produce be "weighed in the balance and found wanting?" If so, the fault will be at the doors of our farmers. The Governments of all our competitors have singled out dairying as an industry worthy of encouragement; the farmers representing those countries have responded to the encouragement thus given, progress has resulted, and as a consequence these countries are taking up a more important position in the world's markets for dairy produce. Our present system of paying average prices for cream and butter lead only to mediocrity, if not to inferiority. These qualities will not avail us much when our produce is placed on the English markets in close competition with that from more progressive countries. This winter in England Australian butter had to take second place to New Zealand. This is the result of two things—irregular supplies, and inferior quality. The New Zealand Department of Agriculture, by authority of Parliament, watches every step in the industry from the time the milk is drawn until the produce leaves their shores.

# HAWKESBURY AGRICULTURAL COLLEGE AND *EXPERIMENTAL FARM.*

## PREPARING MAIZE ENSILAGE AT THE H. A. COLLEGE FARM.

H. W. POTTS.

It is not at all likely that the conservation of forage in the form of ensilage will ever supersede haymaking, but its value for stall-feeding purposes must steadily increase in favour wherever stock-raising or dairying is conducted to any extent during the regular periods of scarcity of natural green food in Australia.

No artificial or conserved fodders can equal good grass. The advantages of green fodder to stock are paramount. Possibly the most palatable and nutritious substitute, particularly for cows in milk, is well made ensilage.

The character of the silage, to a large extent, depends on the class of crop used, the completeness of the silo, and the method adopted to fill it. In numerous instances, the reasons for failure in the past will thus be found. In America and Canada the initial difficulties have been overcome, the principles governing the conversion of green food into a popular and cheap form of ensilage are intelligently followed, and now we find over half a million silos in use in those countries where no dairy farm equipment is considered complete without a silo.

Our experience to date, in Australia, shows that few farmers have persevered sufficiently to master the details of ensilage making. Its value has not been sufficiently demonstrated, and, unless afflicted with drought, we do not seriously attack the problem of this class of food conservation. The recent dry seasons have forced attention, and now we find an inquiring spirit slowly being aroused on this important subject.

Ensilage making at the Hawkesbury College Farm has been persistently conducted for the last eleven years. At first the stack method was adopted successfully. The crops used were barley, wheat, and oats. All were cut with reaper and binder, and the sheaves stacked. Pressure was applied, and this food material formed a palatable, sweet ensilage. Excellent stack ensilage was also made from sorghums, Planter's Friend, Early Amber Cane, and Sorghum Saccharatum—but in each case considerable loss was found in the outside, which dried, and became useless as a food.

One year a good sample of ensilage was made by excavating a hollow in the ground with plough and scoop. This was filled with green maize and covered with earth. One serious objection to this ready and primitive method was that the ensilage got mixed with the soil when removing it. Two underground silo pits were excavated and lined with hardwood. Good results followed the siloing of mixed crops of oats and tares, barley and tares, oats, maize, sorghums; also sorghums and maize in equal proportions. There are many places suitable for excavating for silos. The best results have been experienced in pit silos made of concrete.

The tub silos, however, are proving effective; they are cheaply built, readily filled, and still more easily emptied. Those described by our foreman of works, Mr. Brooks, and in use at the College, have given us great satisfaction, particularly the last tub, built of tongued and grooved timber, thus rendering the exclusion of air almost complete. [*Agricultural Gazette*, September, 1902.]

Our experience has taught us that maize makes the best crop for ensilage, and, for this district, the best varieties are Hickory King, Red Hogan, Abercrombie, and Mastodon.

In preparing the ground (21 acres) for the crop this season, it was ploughed twice, harrowed twice, and rolled once after each ploughing,

A Crop of Maize at H. A. College Farm.

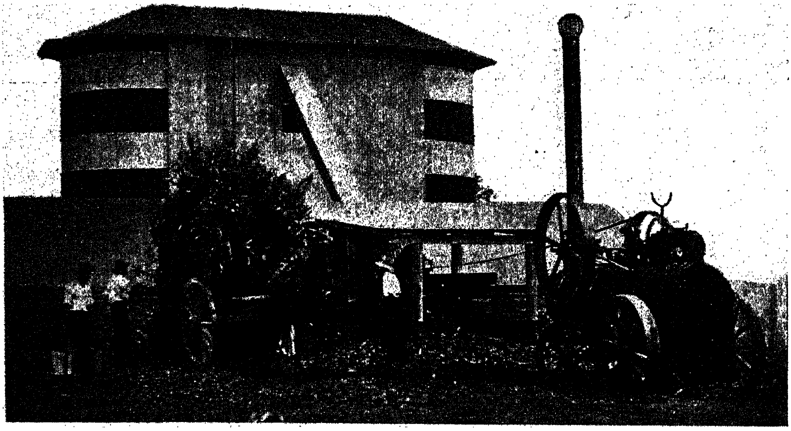
Drilling was effected with a Hornsby ridging plough, 3 feet 6 inches apart, and the grain sown with a Farmer's Friend Corn Planter, About 12 lb. of seed per acre, Red Hogan variety. With the grain was sown 1½ cwt. manure per acre, consisting of two-thirds bone-dust and one-third No. 1 superphosphate. The subsequent system of cultivation whilst the crop was growing commenced with rolling; it was harrowed twice, scuffled twice with Planet Senior or sulkey scuffler, and hilled with Booth, McDonald & Co.'s corn hiller. The crop was sown in September and the first week in October. The first week in February, the maize was cut with the McCormick maize reaper and binder, and conveyed to the tubs, on the north side of which is permanently located an Ohio ensilage cutter. This is fed in the usual

Harvesting with Reaper and Binder.

Maize Harvester—Showing working from rear.

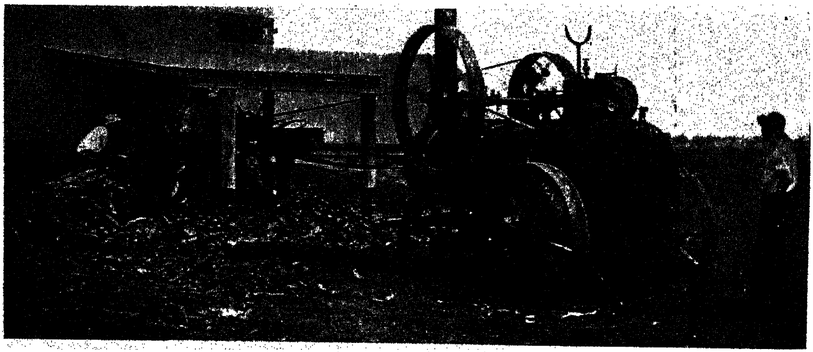
Carrying in the Crop in Sheaves, as left by the Maize Harvester.

ways to the cutter, over a receiving table. The cutter does its work in a smart and complete manner. Its maximum capacity is 15 tons per hour; that, however, is rarely reached. With plenty of strength to load and cart to the silos, they can be filled very rapidly. The plot of 21 acres filled both the tubs illustrated, which hold, when quite full, about 200 tons.



Filling the H. A. College Twin Tub Silos.

One of the main features of success in filling the tub silo is to see that the cut material, as it falls to the centre of the tub, is carefully packed, particularly towards the outer rim near the timber. The great aim is to exclude air, and to tread all material down in such a complete way so as to press out the entangled air. This is more important as the filling approaches the top of the silo, where greater energy and skill is required to perfect the packing and lessen the chances of waste. It is necessary to wait a few days to allow the



Chaffcutter for Silos.

column of food to settle and concentrate. When the shrinkage is stationary, the tub is filled to the surface once more, and with the usual precautions in relation to treading and packing. This will also fall for a time, when it will be necessary to fill again. A few bags of dry chaff scattered over the surface will complete the operations, and the silo is ready to stand until the ensilage is mature.

In dealing with the question of loss, King, of the Wisconsin Experiment Station, whose research work on ensilage is so favourably known, arrives at an estimate, as a result of observations, that, where all conditions are suitable, the necessary reduction of dry matter in making maize ensilage need not exceed 4 to 8 per cent. The loss he aims at estimating is that which occurs in the centre or interior of the mass, where all outside air cannot penetrate. Necessarily his estimate is a low one, and is arrived at under the most favourable circumstances in conserving the fodder.

His silo tub was lined with galvanised iron, and contained 64·7 tons of ensilage. The loss was 6·38 per cent. of dry matter.

The tub was divided into eight distinct layers, and the proportion of loss in each is thus shown :—

| Layer. | Weight. | Lost per cent. of dry matter. | Layer. | Weight. | Lost per cent. of dry matter. |
|---|---|---|---|---|---|
| Surface layer ... | 8,934 lb. | 32·53 | Fourth layer .. | 13,347 lb. | 7·01 |
| Seventh ,, ... | 8,722 ,, | 23·38 | Third ,, ... | 7,723 ,, | 2·75 |
| Sixth ,, ... | 14,661 ,, | 10·25 | Second ,, ... | 12,689 ,, | 3·53 |
| Fifth ,, ... | 48,801 ,, | 2·10 | Bottom ,, ... | 12,619 ,, | 9·47 |

The mean loss in the lower six layers Jordan points out was only 3·66 per cent., and these determinations demonstrate the value of making the silo air-tight.

The larger the silo the more substantial should be the structure, and the best material used to effect an absolute possibility of air reaching the mass during the progress of the fermentative changes.

One important phase in siloing a maize crop is the proper stage of growth or maturity at which the plant should be cut. So far, experience points to considerable latitude being allowed after its maturity has reached a certain condition. An immature plant containing a heavy percentage of water is an unprofitable stage. The full-grown corn, after the grain has begun to glaze, with the lower leaf just turning yellow and the upper ones green, seems to meet the best requirements and provide the largest proportion of dry digestible matter. It is generally agreed that chaffing the maize affords the most relishable and complete food. Naturally it materially aids the accomplishment of the main principle—the exclusion of air.

In practice it has been found best to fill somewhat slowly and continuous, in preference to rapid filling. With a twin silo, such as is used at the College, this can be readily carried out.

## Shredded Maize Stalks.

The problem of utilising the stalks of maize where it is grown for the grain is often not seriously considered, but the recent experience in search of forage of any description has brought into prominence the question of utilising the straw of the maize after husking the ears, or what is often termed stover. So far, several methods are adopted. An implement is used to break down the stalks and chop them into pieces sufficiently short to enable them to be ploughed in. They may be cut and given to cattle and horses as they are; they may be fed off by cattle, horses, or pigs; they may be burned on the land or converted into a fodder as stover and stacked for use after passing through the husker and shredder. At the College farm every year a stack of this fodder is prepared. The McCormick husker and shredder is used (see the illustration). This straw is often termed a waste product, and treated literally as such. In the absence of more palatable food or grass last year, the farm brood mares, colts, fillies, and dry stock ate a large stack of this form of conserved fodder, and we had reason to be thankful that it had been saved for the purpose. Every animal fed on it came out of the dry winter in good condition, and the often despised shredded maize stalks, uninviting as they seem, rendered good service from a food point of view.

Shredder at Work.

This class of fodder has been proved a fattening food for lambs for export combined with other fodder. We know that certain parts of the stalks are relished by dairy cattle. When shredded or chaffed and mixed with cereals or bran and hay, it has some merit for feeding horses.

As a result of tests, the food value of shredded corn has been estimated as at 3 tons equal to 1 ton of clover and timothy hay.

# EGG-LAYING COMPETITION AT H. A. COLLEGE.—RESULTS OF TWELVE MONTHS' TEST.

NOTES BY D. S. THOMPSON,
Poultry Expert.

THE first annual laying competition organised by *The Daily Telegraph*, and conducted at the Hawkesbury Agricultural College by Mr. D. S. Thompson, Government Poultry Expert, terminated on Tuesday, 31st March.

The object of the promoters was to stimulate the systematic breeding of higher standard egg-producing fowls, and results in this respect have exceeded all anticipations. The returns show how very far even many of the leading breeders are behind the best in the State. The average or the best results are not set up as the maximum to be aimed at—far from it, for it is hoped that each year these competitions are continued careful selection and breeding will be reflected in better and better egg yields, and that the average egg-production of the State will improve correspondingly.

In addition to the £31 paid at the end of the first six months, the following prizes have been won:—Greatest number of eggs in the year: Grantham Poultry Farm, first, £4; G. Kennedy, second, £3; M. Ward, third, £2; A. E. Henry, fourth, £1. Greatest number of eggs for the second six months: Grantham Poultry Farm (643), first, £4; G. Kennedy (572), second, £2; Dr. Fiaschi (546), third, £1 10s.; Mrs. A. Hislop (513), fourth, £1; J. F. Brown (502), fifth, 10s. The total winnings were as follows:—M. Ward, £15; Grantham Poultry Farm, £12; G. Kennedy, £8; A. E. Henry, £8; Bosanquet Bros., £2; W. H. Tombs, £2; Dr. Fiaschi, £1 10s.; Mrs. A. Hislop, £1.

It can justly be claimed for this competition that it was the largest ever held in the world, and the first public test of a year's duration. It has exceeded the anticipations of everyone connected with it, especially in the interest it has created throughout the world. Everybody who cares to take an interest in it can learn many lessons from it—thousands are doing so. Many lessons have been gained at the College, where those associated with the test have not been slow to learn; yet there is much more to learn. The pens have been improved, the system of feeding has been improved, and the method of dealing with broody hens has been improved. During the currency of the second competition everything will be done to educate visitors, while those more immediately concerned are diligently profiting by the lessons to be gained from it.

The pens are still well-grassed, and in splendid order. Throughout the competition no case of infectious or contagious disease occurred, and the hens will all be returned in excellent health, although many of them are heavily in moult.

While the conditions under which the competition was conducted can still be improved upon in many ways to bring out the maximum results, the test has demonstrated that poultry-farming, and more particularly egg-farming, will pay. We are able to give details of the laying of almost every appreciated variety of the day, with the cost of food and other necessaries charged against them, and the market value of the eggs, showing the profit which can absolutely be obtained from poultry-farming reasonably conducted.

The monthly laying was:—April, 728; May, 1,052; June, 1,524; July, 2,608; August, 3,097; September, 4,043; October, 3,713; November, 3,213; December, 2,942; January, 2,993; February, 1,774; March, 1,938. Grand total, 29,627.

The food consisted of bran and pollard mash mixed with liver soup in the morning, green food at midday, and maize and wheat alternately at night. The total cost of staple foods for the year was: Pollard, bran and grain, £59 13s. 4d.; meat, £7 16s.; grit, 17s. 6d.; total, £68 6s. 10d. The market value of the eggs laid was £176 9s. 6d., thus showing a profit of £108 2s. 8d. The average value of the eggs was 15s. 6d. per hen, and the cost of feeding 6s., leaving a profit of 9s. 6d. each.

The average results of the various breeds were:—

| | | | |
|---|---|---|---|
| 6 Imperials ... ... ... ... | 880 | eggs, averaging | 146·66 |
| 30 White Leghorns ... ... .. | 4,376 | ,, ,, | 145·86 |
| 48 Black Orpingtons... ... ... | 6,842 | ,, ,, | 142·54 |
| 24 Silver Wyandottes ... ... | 3,421 | ,, ,, | 142·54 |
| 12 Buff Wyandottes... . ... | 1,631 | ,, ,, | 135·92 |
| 6 Birrilees ... ... ... ... | 810 | ,, ,, | 135·00 |
| 24 Buff Orpingtons ... ... ... | 3,227 | ,, ,, | 134·45 |
| 6 Golden Wyandottes ... .. | 753 | ,, ,, | 125·50 |
| 18 White Wyandottes .. ... | 2,040 | ,, ,, | 113·33 |
| 12 Buff Leghorns ... ... ... | 1,342 | ,, ,, | 111·83 |
| 6 White Orpingtons ... ... | 670 | ,, ,, | 111·63 |
| 12 Andalusians ... ... .. | 1,338 | ,, ,, | 111·50 |
| 12 Anconas ... ... ... ... | 1,308 | ,, ,, | 109·00 |
| 12 Minorcas ... ... ... ... | 989 | ,, ,, | 82·41 |
| 228 hens totalled ... ... .. | 29,627 | ,, ,, | 129·94 |

These averages can be read as a good criterion of what the various breeds can do as layers. The conditions governing the competition were not such as would produce data that the world could be asked to accept as final—so far as our State is concerned. Yet there is no doubt that even now the data can be accepted as a first-class guide to the farmer who is seeking for the solution of the problem of which breed will give him the greatest return in value. There is no necessity to publish theoretical or problematical assertions of what breeds can lay. There has been too much of that in the past. All interested can be left to study the details and draw their own conclusions.

The appended table gives full details of the laying and the value and weight of eggs from each pen of six birds. The value has been calculated on the basis of the eggs laid each week and the prices obtained for best new-laid eggs, at the auction sales in Sydney each Friday. The age given is the average of the six birds at the commencement of the competition:—

| Owner, Address, and Breed. | Age—Months. | Eggs Laid. | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | April. | May. | June. | July. | August. | September. | October. | November. | December. | January. | February. | March. | Totals. | Weight per doz. oz. | Market value. |
| 1. Grantham P. Farm, Plumpton: R. C. White Leghorns | 8 | 58 | 69 | 49 | 56 | 102 | 136 | 137 | 106 | 105 | 97 | 96 | 102 | 1,113 | 26 | 140/3 |
| 2. G. Kennedy, Picton: White Leghorns | 13 | 45 | 36 | 60 | 100 | 107 | 121 | 123 | 102 | 112 | 102 | 68 | 65 | 1,041 | 25 | 126/2 |
| 3. M. Ward, Gosford: Black Orpingtons | 7½ | 24 | 82 | 85 | 124 | 118 | 115 | 84 | 81 | 73 | 73 | 75 | 92 | 1,026 | 26 | 131/- |
| 4. A. E. Henry, Ryde: Silver Wyandottes | 11 | 31 | 74 | 101 | 106 | 100 | 107 | 93 | 78 | 94 | 106 | 61 | 69 | 1,020 | 25 | 128 6 |
| 5. J. F. Brown, Summer Hill: Silver Wyandottes | 10 | 31 | 59 | 66 | 82 | 104 | 101 | 101 | 97 | 75 | 96 | 69 | 64 | 945 | 26½ | 117/9 |
| 6. Mrs. G. D. Cheshire, Tempe: Black Orpingtons | 7 | 29 | 36 | 69 | 117 | 99 | 81 | 87 | 81 | 83 | 90 | 52 | 92 | 916 | 24 | 116/6 |
| 7. Mrs. H. Bastin, Enfield: Black Orpingtons | 17 | 32 | 30 | 85 | 105 | 50 | 128 | 96 | 105 | 86 | 77 | 80 | 38 | 912 | 25 | 112/9 |
| 8. J. E. Pemell, Randwick: Buff Wyandottes | 10 | 25 | 38 | 51 | 78 | 107 | 119 | 87 | 76 | 62 | 79 | 81 | 86 | 889 | 24 | 108/9 |
| 9. Bosanquet Bros., Liverpool: Buff Orpingtons | 18 | 58 | 44 | 52 | 108 | 98 | 91 | 73 | 76 | 76 | 75 | 56 | 74 | 881 | 25 | 111/7 |
| 10. W. E. Boutcher, Canterbury: Imperials | 6½ | 27 | 84 | 49 | 74 | 116 | 76 | 71 | 79 | 95 | 80 | 64 | 65 | 880 | 25 | 112/2 |
| 11. E. H. Maxwell, East Hills: Black Orpingtons | 7 | 17 | 42 | 88 | 67 | 81 | 99 | 114 | 84 | 81 | 84 | 39 | 72 | 868 | 24¾ | 107/2 |
| 12. F. Greenwell, Mittagong: Buff Orpingtons | 11 | 27 | 38 | 49 | 102 | 90 | 108 | 79 | 83 | 75 | 76 | 64 | 75 | 866 | 24 | 107/4 |
| 13. E. Waldron, Willoughby: Black Orpingtons | 7½ | 17 | 67 | 66 | 81 | 97 | 114 | 95 | 94 | 70 | 58 | 50 | 54 | 863 | 24 | 107/6 |
| 14. J. J. Roche, Bay View: Black Orpingtons | 9 | 2 | 23 | 59 | 110 | 103 | 111 | 93 | 81 | 74 | 85 | 42 | 52 | 835 | 25 | 102/2 |
| 15. D. Scott, Birrilee: Birrilees | 7½ | 0 | 18 | 34 | 54 | 81 | 130 | 129 | 103 | 119 | 96 | 34 | 12 | 810 | 24 | 89/7 |
| 16. Dr. Fiaschi, Sackville: Black Orpingtons | 6½ | 0 | 0 | 0 | 71 | 68 | 119 | 120 | 106 | 101 | 98 | 59 | 62 | 804 | 26 | 89/6 |
| 17. A. Munroe, Rockdale: Buff Leghorns | 11 | 17 | 18 | 26 | 67 | 80 | 98 | 113 | 96 | 115 | 85 | 47 | 42 | 804 | 24½ | 92/7 |
| 18. A. E. Scarr, Chatswood: White Wyandottes | 8 | 44 | 52 | 44 | 56 | 80 | 101 | 83 | 77 | 74 | 67 | 54 | 71 | 803 | 25 | 101/1 |
| 19. J. D. Callaghan, Homebush: Buff Orpingtons | 12½ | 41 | 5 | 40 | 80 | 110 | 103 | 85 | 70 | 73 | 64 | 41 | 72 | 787 | 26 | 93/7 |
| 20. W. Haydon, Hurstville: White Leghorns | 7 | 7 | 17 | 22 | 83 | 70 | 94 | 124 | 115 | 90 | 83 | 45 | 24 | 774 | 30 | 89/1 |
| 21. W. F. Evenden, Kogarah: Andalusians | 26 | 1 | 0 | 21 | 66 | 68 | 122 | 121 | 99 | 77 | 99 | 45 | 49 | 768 | 30 | 86/2 |
| 22. W. H. Tombs, Penrith: Anconas | 12 | 18 | 66 | 80 | 72 | 105 | 103 | 88 | 67 | 60 | 40 | 10 | 48 | 757 | 26½ | 94/9 |
| 23. A. Hallen, Toongabbie: Golden Wyandottes | 7 | 12 | 0 | 38 | 53 | 100 | 114 | 85 | 80 | 80 | 75 | 39 | 77 | 753 | 25½ | 88/10 |
| 24. Mrs. A. Hislop, Plumpton: White Leghorns | 19 | 3 | 0 | 0 | 3 | 103 | 121 | 126 | 99 | 82 | 111 | 50 | 36 | 743 | 30 | 80/8 |
| 25. H. J. Braithwaite, Luddenham: Silver Wyandottes | 7 | 60 | 53 | 87 | 75 | 53 | 66 | 72 | 60 | 69 | 63 | 43 | 41 | 742 | 23¾ | 97/1 |
| 26. W. H. Peters, Islington: Buff Wyandottes | 6½ | 1 | 0 | 22 | 94 | 107 | 108 | 96 | 84 | 59 | 78 | 41 | 52 | 742 | 25 | 84/6 |
| 27. W. B. Bull, Summer Hill: White Wyandottes | 12 | 21 | 10 | 3 | 56 | 52 | 129 | 101 | 109 | 62 | 51 | 56 | 65 | 715 | 24 | 82/4 |
| 28. J. Young, Burwood, Silver Wyandottes | 19 | 9 | 12 | 35 | 79 | 84 | 106 | 93 | 56 | 83 | 72 | 34 | 51 | 714 | 28 | 83/3 |
| 29. C. K. Horwood, Wagga: White Leghorns | 7 | 11 | 20 | 23 | 47 | 71 | 112 | 101 | 76 | 60 | 118 | 46 | 20 | 705 | 29 | 80/5 |
| 30. H. E. Kelly, Ashfield: Buff Orpingtons | 6 | 14 | 13 | 53 | 99 | 64 | 85 | 85 | 72 | 66 | 60 | 43 | 39 | 793 | 26 | 83/- |
| 31. S. G. Small, Marsfield: White Orpingtons | 10 | 2 | 2 | 19 | 61 | 73 | 116 | 94 | 83 | 64 | 94 | 31 | 31 | 670 | 28 | 74/8 |
| 32. L. L. Ramsay, Carlingford: Black Orpingtons | 17 | 18 | 8 | 5 | 47 | 61 | 77 | 102 | 86 | 85 | 61 | 43 | 25 | 618 | 24 | 69/5 |
| 33. Mrs. J. Burke, Singleton: Andalusians | 5½ | 0 | 0 | 7 | 30 | 30 | 119 | 112 | 99 | 38 | 83 | 13 | 39 | 570 | 30 | 61/- |
| 34. G. Hemsley, Moss Vale: Anconas | 11 | 1 | 1 | 13 | 28 | 83 | 102 | 104 | 75 | 87 | 42 | 5 | 10 | 551 | 26 | 57/8 |
| 35. Mrs. T. Milsop, Arncliffe: Buff Leghorns | 20 | 8 | 21 | 1 | 6 | 71 | 80 | 88 | 80 | 62 | 51 | 41 | 29 | 538 | 26 | 60/4 |
| 37. W. C. Freeman, Randwick: Minorcas | 6½ | 1 | 6 | 21 | 47 | 24 | 104 | 93 | 67 | 60 | 97 | 10 | 0 | 530 | 26 | 57/6 |
| 38. W. Harris, Woy Woy: White Wyandottes | 5½ | 16 | 3 | 0 | 20 | 54 | 107 | 92 | 72 | 72 | 40 | 22 | 24 | 522 | 24 | 56/3 |
| 36. E. J. Winton, Campbelltown: Minorcas | 6 | 0 | 5 | 1 | 4 | 33 | 117 | 95 | 59 | 23 | 87 | 16 | 19 | 459 | 28 | 47/6 |

The following notes may be of considerable value to students and poultry keepers generally:—

Report of types, colours, qualities, weights, number of eggs laid per hen for 12 months, and weight of eggs per dozen, and class of eaters. Table following in order of merit for the 12 months' competition:

### (1). Grantham Poultry Farm.

*Rose Comb White Leghorns.*

Champion layers; beautiful Yankee type Leghorns, with rose combs. America has not yet divulged the development of this breed, and we would hazard the opinion of the infusion of Hamburg blood.

| | |
|---|---|
| Average weight per hen | 5 lb. |
| ,, eggs laid ,, | 185 eggs. |
| ,, weight per dozen eggs | 26 oz. |

Small eaters.

### (2.) G. Kennedy, Picton.

*White Leghorns.*

Crack layers. Four hens of the light American type and two of the larger English type. The four light-weights proved the best layers.

| | |
|---|---|
| Average weight per hen | 4½ lb. |
| ,, eggs laid ,, | 173 eggs. |
| ,, weight per dozen eggs | 25 oz. |

Medium eaters.

### (3.) M. Ward, Gosford.

*Black Orpingtons.*

Winners of the Winter Laying Competition. Medium-sized hens, close feathered, active, ½-lb. per bird under show standard.

| | |
|---|---|
| Average weight per hen | 6½ lb. |
| ,, eggs laid ,, | 171 eggs. |
| ,, weight per dozen eggs | 26 oz. |

Big eaters

### (4.) A. E. Henry, Ryde.

*Silver Wyandottes.*

Good type. Not show laced.

| | |
|---|---|
| Average weight per hen | 5½ lb. |
| ,, eggs laid ,, | 160 eggs. |
| ,, weight per dozen eggs | 25 oz. |

Small eaters.

### (5.) J. F. Brown, Summer Hill.

*Silver Wyandottes.*

Good type. Not show laced.

| | |
|---|---|
| Average weight per hen | 4½ lb. |
| ,, eggs laid ,, | 156 eggs. |
| ,, weight per dozen eggs | 26½ oz. |

Small eaters.

### (6.) Mrs. G. D Cheshire.

*Black Orpingtons.*

Very good show specimen blacks. Three up to standard weight, 7 lb.

| | |
|---|---|
| Average weight per hen | 6½ lb. |
| ,, eggs laid ,, | 153 eggs. |
| ,, weight per dozen eggs | 24 oz. |

Big eaters.

## (7.) Mrs. H. Bastin, Enfield.

*Black Orpingtons.*

Several good show specimens up to standard weight, 7 lb.

| | |
|---|---|
| Average weight per hen | 6½ lb. |
| ,, eggs laid ,, | 152 eggs. |
| ,, weight per dozen eggs | 25 oz. |

Big eaters.

## (8.) J. E. Pemell, Randwick.

*Buff Wyandottes.*

Good show type Wyandottes, but off colour.

| | |
|---|---|
| Average weight per hen | 5½ lb. |
| ,, eggs laid ,, | 148 eggs. |
| ,, weight per dozen eggs | 24 oz. |

Small eaters.

## (9.) Bosanquet Bros., Liverpool.

*Buff Orpingtons.*

Every bird a good show specimen; good in type, colour, and size.

| | |
|---|---|
| Average weight per hen | 5½ lb. |
| ,, eggs laid ,, | 147 eggs. |
| ,, weight per dozen eggs | 25 oz. |

Big eaters.

## (10.) W. E. Boutcher, Canterbury.

*Imperials.*

A good-bodied Orpington type hen made up by Mr. Boutcher, not a recognised breed. They handle very well, and are a very dark fowl, with golden markings, mostly on the breast.

| | |
|---|---|
| Average weight per hen | 5¼ lb. |
| ,, eggs laid ,, | 147 eggs. |
| ,, weight per doz. | 25 oz. |

Big eaters.

## (11.) E. H. Maxwell, East Hills.

*Black Orpingtons.*

Rather leggy; medium sized.

| | |
|---|---|
| Average weight per hen | 5½ lb. |
| ,, eggs laid ,, | 144 eggs. |
| ,, weight per doz. | 24¾ oz. |

Big eaters.

## (12.) F. Greenwell, Mittagong.

*Buff Orpingtons.*

Good type; off colour.

| | |
|---|---|
| Average weight per hen | 5½ lb. |
| ,, eggs laid ,, | 144 eggs. |
| ,, weight per doz. | 24 oz. |

Big eaters.

## (13.) E. Waldron, Willoughby.

*Black Orpingtons.*

Good show type and feather; only medium size.

| | |
|---|---|
| Average weight per hen | 6½ lb. |
| ,, eggs laid ,, | 144 eggs. |
| ,, weight per doz. | 24 oz. |

Big eaters.

### (14.) J. J. Roche, Bay View.

*Black Orpingtons.*

Good show type and feather; only medium size.

| | |
|---|---|
| Average weight per hen ... ... ... ... | 6½ lb. |
| ,, eggs laid ,, ... ... ... .. | 139 eggs. |
| ,, weight per doz. ... .. ... ... | 26 oz. |

Big eaters.

### (15.) D. Scott, Bondi.

*Birrilees.*

A very small black fowl developed by Mr. Scott, evidently composed of Black Hamburg blood and Leghorns; the same principle that we presume they use in developing the Rose-comb Leghorns in America.

| | |
|---|---|
| Average weight per hen ... ... ... ... | 3½ lb. |
| ,, eggs laid ,, ... ... ... ... | 135 eggs. |
| ,, weight per doz. .. ... ... ... | 24 oz. |

Small eaters.

### (16.) Dr. Fiaschi, Sackville Reach.

*Black Orpingtons.*

Very good show specimens; mostly up to standard weight.

| | |
|---|---|
| Average weight per hen ... ... ... ... | 6¾ lb. |
| ,, eggs laid ,, ... ... ... ... | 134 eggs. |
| ,, weight per doz. .. ... .. ... | 26 oz. |

### (17.) A. Munro, Rockdale.

*Buff Leghorns.*

Very good show specimens; typical and good colour.

| | |
|---|---|
| Average weight per hen ... .. ... ... | 4¼ lb. |
| ,, eggs laid ,, ... ... ... ... | 134 eggs. |
| ,, weight per doz. .. ... ... ... | 24½ oz. |

Small eaters.

### (18.) A. E. Scarr, Chatswood.

*White Wyandottes.*

Good show specimens of English standard.

| | |
|---|---|
| Average weight per hen ... .. ... ... | 6½ lb. |
| ,, eggs laid ,, ... ... ... ... | 131 eggs. |
| ,, weight per doz. ... ... ... ... | 25 oz. |

Medium eaters.

### (19.) J. D. Callaghan, Homebush.

*Buff Orpingtons.*

Four very good show specimens; good in colour, type, and size; two partridge marked.

| | |
|---|---|
| Average weight per hen ... ... .. ... | 6½ lb. |
| ,, eggs laid ,, ... ... ... ... | 131 eggs. |
| ,, weight per doz. ... .. ... ... | 26 oz. |

Big eaters.

### (20.) W. Haydon, Hurstville.

*White Leghorns.*

Fine large birds of the present day show type; English standard.

| | |
|---|---|
| Average weight per hen .. ... ... .. | 5 lb. |
| ,, eggs laid ,, ... ... ... .. | 128 eggs. |
| ,, weight per doz. ... ... ... ... | 30 oz. |

Big eaters.

### (21.) W. F. Evenden, Kogarah.

*Andalusians.*

Good type; two fairly well laced; others smoky blue; mostly too old for competition; right type for laying; medium stature.

| | | |
|---|---|---|
| Average weight per hen | ... ... ... ... | 5 lb. |
| ,, eggs laid ,, | ... ... ... ... | 128 eggs. |
| ,, weight per doz. | ... ... ... ... | 30 oz. |

Medium eaters.

### (22.) W. H. Tombs, Penrith.

*Anconas.*

From what has been seen in the show pen, and in the competition pen of Anconas, it is evidently a very difficult matter to breed a show-coloured specimen. Mr. Hemsley's Anconas are about the usual colour bred, simply black and white spangling, and fanciers taking up this variety will find it exercise their scientific powers in producing a black white laced specimen up to show standard.

| | | |
|---|---|---|
| Average weight per hen | ... ... ... ... | 4¼ lb. |
| ,, eggs laid ,, | ... ... ... ... | 126 eggs. |
| ,, weight per doz. | ... ... ... ... | 26½ oz. |

Small eaters.

### (23.) A. Hallen, Toongabbie.

*Golden Wyandottes.*

Good Wyandotte type; not show laced.

| | | |
|---|---|---|
| Average weight per hen | ... ... ... ... | 4¾ lb. |
| ,, eggs laid ,, | ... ... ... ... | 125 eggs. |
| ,, weight per doz. | ... ... ... ... | 25½ oz. |

Small eaters.

### (24.) Mrs. A. Hislop, Plumpton.

*White Leghorns.*

Mostly big-bodied English standard hens.

| | | |
|---|---|---|
| Average weight per hen | ... ... ... ... | 4½ lb. |
| ,, eggs laid ,, | ... ... ... ... | 124 eggs. |
| ,, weight per doz. | ... ... ... ... | 30 oz. |

Big eaters.

### (25.) H. J. Braithwaite, Luddenham.

*Silver Wyandottes.*

Good type; not show marked.

| | | |
|---|---|---|
| Average weight per hen | ... ... ... ... | 5½ lb. |
| ,, eggs laid ,, | ... ... ... ... | 124 eggs. |
| ,, weight per doz. | ... ... ... ... | 23¾ oz. |

### (26.) W. H. Peters, Newcastle.

*Buff Wyandottes.*

Real good lot of show type Wyandottes.

| | | |
|---|---|---|
| Average weight per hen | ... ... ... ... | 5½ lb. |
| ,, eggs laid ,, | ... ... ... ... | 124 eggs. |
| ,, weight per doz. | ... ... ... ... | 25 oz. |

Small eaters.

### (27.) W. B. Bull, Summer Hill.

*White Wyandottes.*

Mostly real good show specimens; good in size, type, and colour.

| | | |
|---|---|---|
| Average weight per hen | ... ... ... ... | 6 lb. |
| ,, eggs laid ,, | ... ... ... ... | 119 eggs. |
| ,, weight per doz. | ... ... ... ... | 24 oz. |

Small eaters.

### (28.) J. Young, Burwood.

*Silver Wyandottes.*

Three hens very good show specimens, well laced ; others off colour.

| | |
|---|---|
| Average weight per hen ... ... ... .. | 6 lb. |
| ,, eggs laid ,, ... ... ... ... | 119 eggs. |
| ,, weight per doz. ... ... ... ... | 28 oz. |

Small eaters.

### (29.) C. K. Horwood, Wagga.

*White Leghorns.*

Mostly attractive American types.

| | |
|---|---|
| Average weight per hen ... ... ... ... | 4¾ lb. |
| ,, eggs laid ,, ... ... ... .. | 117 eggs. |
| ,, weight per doz. ... ... ... ... | 29 oz. |

Big eaters.

### (30.) H. E. Kelly, Ashfield.

*Buff Orpingtons.*

Very "Cochin"; low set.

| | |
|---|---|
| Average weight per hen ... ... ... ... | 5½ lb. |
| ,, eggs laid ,, ... ... ... ... | 115 eggs. |
| ,, weight per doz. ... ... ... ... | 26 oz. |

Medium eaters.

### (31.) S. G. Small, Marsfield.

*White Orpingtons.*

This is the hardest pen to say anything about in the competition ; the most we shall say is that they are nothing similar in type to the Black Orpington.

| | |
|---|---|
| Average weight per hen ... ... ... ... | 6 lb. |
| ,, eggs laid ,, ... ... ... ... | 112 eggs. |
| ,, weight per doz. ... ... ... ... | 28 oz. |

Big eaters.

### (32.) L. L. Ramsay, Carlingford.

*Black Orpingtons.*

Every one a show bird, deep bodied, short legged, and large.

| | |
|---|---|
| Average weight per hen ... ... ... ... | 7½ lb. |
| ,, eggs laid ,, .. ... ... ... | 103 eggs |
| ,, weight per doz. ... ... ... ... | 24 oz. |

Big eaters.

### (33.) Mrs. J. Burke, Singleton.

*Andalusians.*

Beautiful show specimens ; modern type, leggy, and well laced.

| | |
|---|---|
| Average weight per hen ... ... .. ... | 5½ lb. |
| ,, eggs laid ,, ... ... ... ... | 95 eggs. |
| ,, weight per doz. ... ... ... ... | 30 oz. |

Big eaters.

### (34.) O. G. Hemsley, Moss Vale.

*Anconas.*

Same remarks as to W. H. Tombs'.

| | |
|---|---|
| Average weight per hen ... ... ... ... | 3½ lb. |
| ,, eggs laid ,, ... ... ... ... | 92 eggs. |
| ,, weight per doz. ... ... ... ... | 26 oz. |

Small eaters.

### (35.) Mrs. J. Milsop, Arncliffe.

*Buff Leghorns.*

First-class show specimens; too old for competition.

| | |
|---|---|
| Average weight per hen | 4¼ lb. |
| ,, eggs laid ,, | 90 eggs. |
| ,, weight per doz. | 26 oz. |

Small eaters.

### (36.) W. C. Freeman, Randwick.

*Minorcas.*

Old type; low set Minorcas; very young; only five hens last six months.

| | |
|---|---|
| Average weight per hen | 4¼ lb. |
| ,, eggs laid ,, | 88 eggs. |
| ,, weight per doz. | 26 oz. |

Big eaters.

### (37.) W. Harris, Woy Woy.

*White Wyandottes.*

Entered very young; first-class show specimens; English type.

| | |
|---|---|
| Average weight per hen | 5½ lb. |
| ,, eggs laid ,, | 87 eggs. |
| ,, weight per doz. | 24 oz. |

Small eaters.

### (38.) E. J. Winton, Campbelltown.

*Minorcas.*

Medium show type.

| | |
|---|---|
| Average weight per hen | 6 lb. |
| ,, eggs laid ,, | 76 eggs. |
| ,, weight per doz. | 28 oz. |

Big eaters.

## *American Birds.*

### Pen No. 24. W. B. Candee.

*White Wyandottes.*

Totally dissimilar to our White Wyandottes, much neater in head, more active, short on leg, and Hamburgy.

| | |
|---|---|
| Average weight per hen | 4½ lb. |
| ,, ,, per doz. eggs | 20 oz. |

### Mrs. Hansell.

*Brown Leghorns.*

Very dark in colour, rose combs; very small, evidently from Hamburg and Leghorn blood.

| | |
|---|---|
| Average weight per hen | 3¼ lb. |
| ,, ,, per doz. eggs | 20½ oz. |

### W. K. Hays.

*White Wyandottes.*

Similar to Candee's.

| | |
|---|---|
| Average weight per hen | 4 lb. |
| ,, ,, per doz. eggs | 20 oz. |

The American birds arrived in terribly poor condition, and must have felt the effects of the voyage very much. They are all laying now, which shows that if hens can lay under such conditions, they must be great layers. We have given them good quarters, and will give them even more attention than could possibly be given to the whole seventy pens.

# ARROWROOT.

C. T. MUSSON.

## Extracting Starch on a small scale from Canna Edulis.

FOR anything up to a ton of arrowroot bulbs the following method of extracting the starch may be followed :—

Get a sheet of galvanised iron 10 inches wide and 2 feet long; punch it full of holes a quarter of an inch apart with a small nail or punch; the holes must be small so that the flesh is readily broken up into sufficiently small particles. Leave an inch margin all round unpunched; double the iron over and nail it on to a board, as in illustration. The sharp edges of the punched holes will then project outwards. With several of these graters a considerable quantity of arrowroot bulbs (so-called) can be worked.

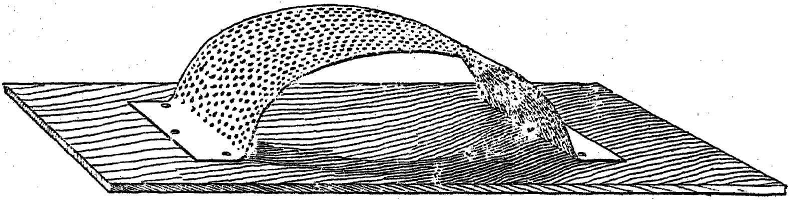


Fig. 1.

The bulbs must be *washed* and rubbed down (grated) on a grater, the pulp being collected in a tub. From 100 lb. of bulbs, 15 to 20 lb. of starch should be obtained —the actual percentage of starch being about 28 lb., but this cannot all be saved, even with the best appliances for extraction there is a certain loss.

Next, *sift the pulp in water*, using a fine sieve which will allow the starch (and even the fine vegetable matter to be afterwards got rid of) to pass through into the receptacle used, such as a bucket. Only a small quantity can be sifted at a time—the same water can be used until the sifting is all done; the number and size of the receptacles depending on the quantity of starch.

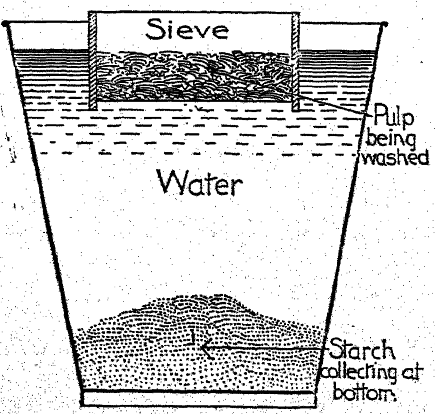


Fig. 2.

When sifting is finished, put the material remaining through the sieve again; also a third time if it is found there is still some vegetable matter remaining.

During the sifting operation the sieve is gently rotated in order the better to separate the starch from the retained vegetable matter.

*Washing in water* a dozen or twenty times will now be necessary, in order to get rid of the balance of the useless matter—the pure starch grains free from refuse being alone required. In order to attain this end fill the bucket with water, stir the starch up, and allow it to settle again, *then* pour off the dirty water. This operation must be repeated until the water poured off is quite clear. It will take some hours for the starch to settle solid. Six or eight washings, even more, may be necessary.

There will now remain a certain amount of *scum* (mainly light vegetable matter) and some *dregs* (sand grains, &c.) The scum is got rid of by stirring up the top half-inch of starch (which contains it) in plentiful water; allow a short time for the starch to settle, and pour off the turbid water; repeat this until all floating refuse has been cleared away. The dregs may be got rid of by decanting: Stir the whole of the starch up in water and while the starch is floating, but after allowing a few seconds for heavy dirt to fall, pour the whole rapidly into another bucket, leaving the dregs behind; repeat until all dregs have been removed. Any starch still with the dregs may be recovered by careful washing. With care, there need be very little waste in these operations necessary for the removal of scum and dregs, which can thus be completely got rid of. A large glass jar is a very handy thing to use in these final washings, as the scum and dregs are easily seen.

By these operations all refuse can be removed, leaving the starch perfectly free from extraneous matter. It can now be dug out of the receptacle with a large spoon, and spread on calico to dry; it dries quicker if the calico is laid on wire netting, fastened to stakes, raising it from the ground. There are sundry little dodges in manipulating the washing operations that cannot be described; such are readily found out by the operator.

*Cultivation.*—For details as to cultivation readers should refer to *Agricultural Gazette,* vol. II, p. 511, which also gives particulars as to machinery required (pulper and washer) if the starch is to be extracted on a large scale.

Illustrations, with a description of such machinery, were published some years ago in the *Town and Country Journal,* reference to which is, however, not at hand.

## FARM NOTES FOR THE HAWKESBURY DISTRICT.

H. W. POTTS.

THE recent rains have relieved the situation largely from a farming point of view. The subsoil still remains dry, although the showers about Easter time were heavy enough to penetrate about a foot. The prospects are brighter this season than last, and large sowings of wheat ought to be made throughout the month. Blount's Lambrigg may be sown for hay. Amongst the varieties most suitable for this district may be mentioned Steinwedel, Allora Spring, White Lammas, Nut Cut, Nonpareil, and Australian Talavera. The two former are quickly maturing sorts. The quantity found best for grain is ¾ bushel to the acre and for hay 1¼ bushel.

In most of the poor lands of the Hawkesbury manure is required, and experience tends to show that 2 parts of bone dust to 1 part superphosphate is the best, and about 1½ cwt. per acre. In all cases the grain is best put in with the drill. As to methods of preparation, the land should be ploughed twice, and harrowed after each ploughing, and to harrow the second time followed by rolling prior to drilling. Harrow and roll again after getting the grain and manure in.

*Barley.*—To secure a succession of green crops extending into spring, it will be advisable to put in a further crop of Cape Barley. One advantage to be remembered in a succession of crops is, if the season be favourable and there is ample feed, the crop can be conserved as ensilage; an advantage may also be gained by mixing vetches with the crop in the proportion of 1 to 5. This crop provides splendid fodder, and it comes in about the end of September or early in October at a time when dairy cattle can use it as well. A variety known as Algerian Barley has been found to provide the best crop with vetches. When barley is sown alone 1½ bushels of seed per acre will be found sufficient.

*Oats.*—Early this month sowings of Tartarian and Dun Oats may be made to provide hay crops in early spring. Care should be exercised in the selection of good, clean, plump seed. Two bushels per acre is required. In all cases it is best drilled with fertilisers such as are recommended for wheat. Towards the latter end of the month the main crop of Algerian oats may be sown.

*Rye.*—This useful crop ought never to be neglected. It makes splendid green food for cattle, and sown now will be ready about August. We find the Imperial and Thousandfold sorts the best for this district, 1¼ bushels per acre. In sowing rye one half the manure recommended for wheat will be found enough.

*Lucerne and Clover.*—Although late in the season, yet in the early part of the month the risk might be taken and sowings put in for these useful fodders.

*Turnips and Swedes and Rape.*—Small sowings might be continued this month. The opportunity is offered this month to sow rape. We must fully realise this as a very serviceable crop for early spring for sheep and pigs; and as a crop on which to follow with maize it has the dual advantage of providing forage and manuring the ground.

*Field Peas and Beans*—May be sown this month, and although many farms on the Hawkesbury are unsuitable for such crops, yet there are some where they give excellent yields. For either feed or ploughing in the grey or dun field pea answers best.

# Farm Notes.

## RIVERINA DISTRICT.—MAY.

G. M. McKEOWN.

*Wheat.*—The present month is one of the best for sowing wheat, but except under unusually favourable conditions it should not be delayed beyond the first week in June. Too much stress cannot be laid on the necessity for thorough preparation of the soil, as larger crops may be obtained from moderate areas well treated than from extensive areas which are simply "scratched," as is too often the case. The use of manures in moderate quantities is recommended, profitable results having been obtained from a maximum expenditure of 3s. per acre and as low as 14d. per acre, the best results having been obtained from superphosphates drilled in with the seed. The Purple Straw varieties have so far proved the most consistent croppers in Riverina.

*Barley.*—In the free soils of the higher lands of the district profitable crops of malting barley may be raised, while in fair seasons good crops may be obtained on the lower lands with the aid of manure. The soil should be as deeply worked as is possible without bringing any of the subsoil to the surface, and should be brought into a fine condition by means of harrowing and rolling if necessary. Seed should be drilled at the rate of 25 to 30 lb. per acre, and with the seed should be sown superphosphate 60 lb. per acre. The best yields of grain have been obtained on the farm from Kinver and Golden Grain, Hallett's Chevalier being next in order. For green fodder, sow either Cape or the skinless variety, the latter being preferable, as it is beardless. For fodder, sow ¾ to 1 bushel per acre.

*Green Fodder.*—Sow field peas and beans, vetches, oats, and rape. Lucerne and sheep's burnet may still be sown, if put in promptly.

*Kitchen Garden.*—Plant tree onions, potato onions, and eschalots, and sow onion seed on a limited scale only. Sow seed of cabbage and cauliflower, and transplant into well-prepared soil available plants of either kind. Among the best varieties of cabbage will be found Early Drumhead, Succession, and Improved St. John's Day; and cauliflowers, Early London and Asiatic. Sow broad beans and peas, of the latter the best being Yorkshire Hero, Stanley, and Daisy. Turnips, white and yellow varieties may still be sown.

# Orchard Notes.

W. J. ALLEN.

## MAY.

WHERE it is intended to plant deciduous trees, either as refills or in laying out a new orchard, no time should be lost in getting the land into fit condition to receive them. If the trees are not already ordered, this should be done without further delay, and they should be planted immediately upon delivery.

In the average soil, the most suitable distance apart for planting apples, citrus fruits, peaches, nectarines, plums, pears, and apricots is 24 feet; in very rich soil, however, this distance may with advantage be extended to 30 feet. A few varieties of plums and pears would, perhaps, do well if planted 20 feet apart; but, generally speaking, I favour giving trees a good space of ground to feed in, as, owing to the recurrence of droughts, the trees, if they are of any age and planted close together, are bound to suffer more than those which have been allowed a liberal space of land from which to draw nourishment.

The following table shows the number of trees or vines to the acre at the distances apart given, viz.:—

| Distance apart. | Number. | Distance apart. | Number. |
|---|---|---|---|
| 4 x 4 | 2,722 | 15 x 15 | 193 |
| 5 x 5 | 1,742 | 16 x 16 | 170 |
| 6 x 6 | 1,210 | 17 x 17 | 150 |
| 7 x 7 | 888 | 18 x 18 | 134 |
| 8 x 8 | 680 | 19 x 19 | 120 |
| 9 x 9 | 537 | 20 x 20 | 108 |
| 10 x 10 | 435 | 25 x 25 | 69 |
| 11 x 11 | 360 | 30 x 30 | 48 |
| 12 x 12 | 302 | 35 x 35 | 35 |
| 13 x 13 | 257 | 40 x 40 | 27 |
| 14 x 14 | 222 | | |

Many of our nurserymen fumigate the trees before sending them from the nursery, as an extra precaution against any unforeseen pest which might have settled on them by chance. I am pleased to say that we have nurserymen carrying stocks free from diseases, and it is from such nurserymen that growers should endeavour to procure their trees, as the average orchardist has quite enough to put up with, without the further imposition upon him of an army of pests introduced with his nursery stock.

In every case, the yearling tree is the best to buy, yet many there are who order the older or larger trees, being led away with the mistaken idea that the largest must be the best. A well-grown yearling tree is always preferable.

Pruning may be started towards the end of the month; but if the orchardist can put it off until next month it would be as well, as there is no advantage to be derived from pruning too early.

Citrus fruits and pineapples, where at all subject to frosts, should be properly protected before they have suffered damage from these causes. This may be done by binding loosely about the young tree a sheaf of maize or sorghum stalks, tea-tree bush, or anything that will afford the tender foliage fair shelter.

Many of our fruitgrowers are now using lime in varying quantities from a half to one ton per acre, and have derived very gratifying results from its use. Lime has the effect of changing the physical properties of a clay soil, making it more friable and easily cultivated, and putting it into a condition so that water may pass more freely through it. This will make it less susceptible to extremes of dry or wet weather, and make it a good home for the roots of the plants. The action of lime on sandy soils will naturally be the reverse of that on clay soils, and makes such soils stick together, and in such condition that they will hold more water and not dry out so quickly.

See that no codlin moth grubs are left under the bandages on the trees; but, instead of removing the latter, allow them to remain for a month or two, as it is possible that during the cold and rainy season a few odd ones may be driven from their shelter, and will find a refuge in these bandages. The latter, however, need only be examined occasionally. I would strongly urge those who have been troubled with the San José to spray the trees with the lime, sulphur, and salt solution after pruning, and not to fail in burning all prunings. In this way the very worst trees can be practically cured at a very small cost.

## TREATMENT OF BEES FOR FOUL-BROOD.

IN reply to a correspondent, who asks for information as to the treatment of bees for foul-blood, Mr. Albert Gale has furnished the following advice:—Shake the bees into a clean hive, *i.e.*, one free from disease. This can be done by removing each frame of comb separately, brushing the bees off, and transferring them into the new hive, which should be stood on the site occupied by the diseased one. When all the bees have been transferred to the clean hive, shut them in and keep them without food for about four days. Care should be taken to examine them from time to time during the period of incarceration to see whether any are dying of starvation. If such should be the case, the bees must be allowed out to gather some food for a few hours, or honey fed to them.

The new hive should be fitted with new frames and narrow starters of foundation comb.

All the diseased combs containing brood should be burnt, and the diseased hive thoroughly disinfected with boiling water and soda, until it is as clean inside and out as a new pin. The honey contained in foul-brood combs is not deleterious to human beings.

# Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

## DIRECTIONS FOR THE MONTH OF MAY.

### Vegetables.

THE vegetables have, lately, been as satisfactory as could be desired in districts which have been benefited by fair rains. The growth of many kinds has improved considerably in places where not very long ago dry weather was prevalent. No one should ever give up hope when growing vegetables or any other plants, and should have everything ready for planting and sowing when the weather breaks.

If the ground be turned up in ridges, either by spade or plough, it is not a very difficult matter to harrow and level down the surface sufficiently well for seed-sowing or planting. If ridged or dug roughly in the dry weather, the rain has an opportunity of sinking into the soil; whereas if left without any preparation, the rain would penetrate but slightly, and the best part of it would be lost. I have tried this over and over again, and am quite satisfied that not only with respect to vegetables, but to farm crops of all kinds, that the loss of precious water is enormous where preparations for making the most of all the rain that falls are not taken in hand in good time. This is a subject deserving of great attention, and which might be enlarged upon considerably if space permitted.

It is pleasing to know that these gardening directions are availed of largely—as I have discovered when travelling through the country—and I greatly regret that it is not possible to enlarge them owing to the limited size of the *Agricultural Gazette*.

The gardener should always be ahead with his work, and thus save time and annoyance. As soon as vegetables are removed sow or plant others, but to carry this out successfully it would be well to keep notes of the best kinds to follow one another. If, say, that you desire to plant cabbage after potatoes, note this some time ahead, and as the potatoes are removed manure well and plant cabbage, and so on with other vegetables. By keeping a plan of the garden, showing the various kinds of vegetables, the work of cropping successfully and economically can be managed not only without any trouble, but should give an additional interest to the garden.

*Asparagus.*—It may be as well to prepare for the planting of this vegetable, which, however, need not be planted until the early spring. When making the bed keep the surface low, even an inch or two below the level if it can be managed. Vegetable-beds, or flower-beds raised high above the surface of the general level or the level of the road or walks, are not satisfactory during dry weather; and even should rains fall abundantly there need be no fear of the low beds if they be properly drained. There is some excuse for raising onion and potato beds somewhat, for both these vegetables need the very best drainage and the speedy get-away of surface water.

*Beans, Broad.*—This being one of the best times of the year for sowing this vegetable, plant as extensively as may be required—say every week. Sow in rows, the distance apart to be regulated according to the heights to which the different kinds are likely to attain—from 1 foot to about 4 feet. Sow the seed about from 3 to 4 inches deep and about 4 or 5 inches apart in the rows. The seeds are generally extremely hard, and may be improved by a soaking in water for an hour or two before sowing—that is if the soil is fairly moist, but if it be very dry, sow without soaking the beans. The reason for this is that, after soaking, the beans will start into growth, and if the soil is dry, the young tender growth will suffer from want of moisture and perish, unless rain happens to fall in the nick of time to save them.

*Beans, French or Kidney.*—Sow only in the warmest parts of the State where early frosts are not likely to occur.

*Beet, Red and Silver.*—Cultivate the growing plants well and thin out seedlings, but it is hardly worth chancing the sowing of any more seed for the present.

*Borecole or Kale.*—Sow a little seed, and if any plants have been raised, and are large enough to move, plant them out as you would cabbages.

*Brussels Sprouts.*—An effort should be made to grow this vegetable, for it is a good one, and cannot fail to give satisfaction to those who are successful in growing it. Use plenty of manure when preparing ground for planting. Seed may be sown and young plants may be planted if they are ready.

*Cabbage.*—Sow seed of any suitable kind. Succession is a good variety, and so also is Phenomenal, a new variety tested by Mr. Ellis at the Howlong Vine Nursery for me; but smaller kinds are well worth growing, and are generally more tasty and tender than the large and strong growing kinds.

*Cauliflower.*—This needs more attention from the start than other members of the family. It should be grown without a check from the germinating of the seed, and care should be taken when transplanting, for a little care will or should repay the trouble. Sow a little seed and plant out any strong young cauliflowers on hand.

*Carrot.*—Sow a little seed in order to keep up a succession. Thin out well as soon as the seedlings have attained a height of 2 or 3 inches, and keep the rows well weeded.

*Celery.*—A few plants may be planted now and then. Advanced plants which have pretty well attained full growth may be earthed up. As a large supply is not likely to be required, there is no need to set out very many plants at a time.

*Endive.*—Sow a little seed, and plant out from previous sowings. This is a good substitute for lettuce in cold districts.

*Leek.*—Seed may be sown extensively, and any young leeks already raised, and which are as large as an ordinary penholder, may be planted in very rich soil or soil made rich with abundance of good manure. If the weather and soil are very dry and water is not available in good quantity do not plant.

*Lettuce.*—Sow as extensively from time to time during the month as you may desire, and plant out any strong young lettuces available.

*Onion.*—This is an excellent time, in many parts of the State to sow onion seed. When preparing the onion bed use manure freely, mix it well with the soil and make the surface level and as fine as you possibly can. Sow the seed in drills, and cover with very little fine soil. When the plants come up do not allow any weeds to grow amongst them.

*Parsley.*—Sow a little seed. There is a tradition that it is unlucky to transplant parsley, and at one time gardeners would absolutely refuse to transplant it.

*Parsnip.*—Sow a little seed occasionally.

*Peas.*—Sow largely from time to time during the month.

*Radish.*—Sow a little seed occasionally.

*Spinach.*—Sow a little seed occasionally in drills about 15 inches apart. Thin out the plants when they are 2 or 3 inches in height.

*Shallots.*—Plant out bulbs as extensively as you need about 1 foot apart each way.

*Herbs.*—Sow a little seed of various kinds.

## Flowers.

THERE is still time to plant out any of the beautiful spring flowering bulbs that may be required, but the work should be completed as soon as possible.

Daffodils and other members of the Narcissus family are perhaps the favourites. Few persons really know which are daffodils and which are not. This is explained very simply by the Rev. S. E. Bourne, M.A., in a valuable article contributed by him to the Royal Horticultural Society, London. He says that "in the Narcissus family there are three main groups, distinguished by the size and shape of the corona of the flower." The "corona" is the tube in the centre of the flower, and cannot possibly be mistaken. He continues: "(1) the Magni-coronati; (2) the Medio-coronati; (3) the Parvi-coronati." That is the large tube or trumpet, the medium-sized tube or trumpet, and the small tube or trumpet. "The Magni-coronati are the large or long-crowned Narcissus, called Trumpet Narcissus from the trumpet-like shape of the corona. These are the true daffodils."

Recently-planted trees, shrubs, and perennials should be well looked after, and if the weather is dry occasional watering may probably be necessary. Violets, pansies, daisies, polyanthuses, and cowslips should be planted early in the month.

Fallen leaves had better be collected from the garden and taken to the manure heap, where they will rot and make good manure.

Sow seeds of hardy annuals and of perennials and biennials. Plant out any that have come up from seed already sown. Attend to them after planting, and do not let them suffer from want of water or too much sun.

# General Notes.

## SPRAYING FOR SAN JOSÉ SCALE ON APPLE-TREES.

MR. J. E. DALE of Cairnes-road, Glenorie, reports: "Having a patch of Carrington apple-trees which were so badly infested with scale two years ago that the fruit was practically unsaleable, I consulted the fruit expert when he visited my orchard. Mr. Allen said the pest was San José scale, and recommended spraying with lime, salt and sulphur wash, prepared according to the formula in the work on "Insect and Fungus Diseases and their Treatment," published by the Department. I have now sprayed two seasons with the wash and my trees are very clean. Just as the last of the fruit was pulled I noticed a few odd scales on them, but very few. I have also treated my pear-trees in the same manner for the same complaint and they are thoroughly clean. I trust this may be brought under the notice of other fruit-growers who are troubled with this pest."

## WHEATS AT PARKVILLE.

IN a report on the results of trial sowings of some of the cross-bred wheats raised by the wheat experimentalist to the Department, Mr. A. J. Brown of Parkville, states: "I received three varieties in time to sow last season. "Federation" proved unsuitable here, but "Bobs" and "Jonathan" have done well and although sown on very poor soil, without any aid whatever, have given me a nice sample of grain. This is very encouraging, especially as neither kind showed any sign of rust, although in close proximity to a very rusty paddock, and I have decided to save every seed for a further and more extended trial."

Mr. Brown adds that the rust in the vicinity of the trial plots of Mr. Farrer's cross-bred wheats was very bad.

## RUSSIAN AND SIBERIAN BUTTER IN ENGLAND.

RUSSIA, as is well known, is making great efforts to open up the English markets to her agricultural produce, butcher's meat, &c. In 1901, she despatched there more than 30,000,000 of eggs; and in the butter trade specially, she has taken the first place, which France occupied about 15 years ago, before Denmark and Australia had started in the same line of trade. Russia does not mean to stop here, but threatens to become the most formidable competitor for butter which suppliers to the London market have ever had to deal with. From the value of £470,000, in 1896, the export of Russian and Siberian butter reached more than £650,000, in 1900, and in 1901,

£1,025,000. During this time the export of French butter, of a very much better quality, but of a rather higher price, suffered from the momentary constraint caused by the South African war, and fell from £1,600,000 in 1896, to £1,125,000 in 1900, and in 1901 to £1,075,000.

Our rivals, calculating beforehand that this situation would be highly unfavorable for us, entertained the hope that the customers in the United Kingdom would henceforth be secured by themselves. To this end, not only did the Imperial Commission sent to the country a year ago, make every effort, but also a specialist, Dr. Kalandoor, has since been sent there as a delegate to draw attention to the good quality of the butter, and to defend it against all detractors, as well as to study the best means of putting into direct communication with British merchants the distant factories whose products up to the present have passed through several costly intermediaries—commission agents of all sorts and nationalities.

Concerning the butter which comes from beyond the Ural Mountains, the railway companies have so arranged to diminish the rates, that the total freight from Kourgan to London, shall not be more than 16s. 6d. per ton, which means 1 penny per lb. on a voyage of not less than four weeks. We are also informed that the Government of St. Petersburg has ordered the construction of 465 specially arranged refrigerating waggons, to be added to the 570 already existing.

This is a serious state of affairs. How have our products, which already have much difficulty in defying the strong competition from the Danish article, to resist this fresh invasion of Russian butter? We venture to ask the French exporting syndicates if the only means is not what has been so frequently recommended by this Consulate—to reduce the selling price, but at the same time to maintain the superior quality of the article. The question is to-day more necessary and more indispensable than ever.—M. AUZEPY, Consul-General for France (in the *Journal de l'Agriculture*).

## ON THE VALUE OF LIQUID MANURE.

M. H. SAGNIER, writing in the *Journal de l'Agriculture*, of France, states:—The President of the Agricultural Syndicate desires us to call attention to the serious losses sustained by those farmers who allow the liquid from their manure heaps to flow away into pits or ditches. In the district around here 98 per 100 of the farmers have neither manure heap nor pit. Sometimes the liquid flows away into a pit from which the farm animals go to drink. Very often this same water is used for making cider. I will point out the heavy monetary loss sustained by such negligence. It is a long time since this was first pointed out; but we repeat it willingly, and will do our best to spread the information. In the sixteenth century, Bernard Palissy deplored the ignorance and carelessness of farmers who allowed the rains to wash away the liquid from their manure heaps, which, as he remarked, contained the principal fertilising matters.

Later, M. de Dombasle made the same observations, and he indicated the best means of constructing a simple and economical manure tank, which would prevent the loss of the liquid.

"The farmers," said Mole, sixty years ago, "do not dream that the small thread of liquid which escapes from their manure heaps is always running, and increases at each rainfall."

With six or eight horses, as many cows and oxen, and perhaps 100 sheep, more than 4,400 gallons may be collected per year, when kept in such a manner that none is lost.

If this was used on the fields, the crops would show an enormous increase.

"We can at once," says Boussingault, "judge of the intelligence and industry of a farmer, by the care that he takes of his manure heap." Girardin adds that "the farmer, who, either through idleness, negligence, or parsimony, allows the liquid manure to flow away into pits or ditches is throwing his money into the street."

Finally, we will add the opinion of Messrs. Muntz and Girard, which rests upon the chemical analyses of the manure from the animals themselves, as well as of samples from the manure heap.

"When through negligence," they say "the liquids are lost, the farm is deprived of very important quantities of nitrogen and potash, and the farmer ought, therefore, to give every attention to retaining the liquid portion of the manure, which is of far greater importance than the solid."

We are requested to fix the money value of loss in manure on ill-kept farms.

It is impossible to do this in a uniform manner, as it depends on a great number of conditions. The quantity of liquids from the animals varies, according to the food they receive, and is more or less absorbed by the litter.

The liquid manure is not composed entirely of the urine, but also of part of the solid elements in the manure.

However, we can calculate approximately the value of the liquid lost under ordinary conditions.

The average weight of daily urine from a beast is 22 lb., and contains equal to 0·75 to 0·80 per cent. of nitrogen and 1·55 to 1·60 per cent. of potash.

Accordingly the quantity of nitrogen per year would be 63 lb., and of potash, 126 lb.

This quantity of nitrogenous matter corresponds to 400 lb. of nitrate of soda, which at the very low price of 8s. 4d. per cwt. would amount to £1 9s. 9d. The potash, equalling 257 lb. of chlorine of potassium at 8s. per cwt. would be worth 17s. 3d.

The value of the annual liquid from each animal may thus be estimated at £2 7s. If we admit that only two-thirds of this are lost by being washed away, it is a sum of £1 11s. 4d., which, according to Girardin's remark, the farmer pitches into the street.

For a stable of five animals, the annual loss under these conditions would amount to £7 6s. 8d.

These figures should cause us to reflect.

## SWINE-FEVER.

NOTES FROM OFFICIAL REPORTS CONTRIBUTED BY EDWARD STANLEY, F.R.C.V.S.,
Chief Veterinarian.

SWINE-FEVER is known nearly all over the world; it has been reported in New Zealand and in Queensland, therefore it is reasonable to attribute this outbreak in New South Wales to its introduction by infected swine either from oversea or overland.

Symptoms of the disease will depend on the organs affected, as the disease is found in the lungs, lymphatic glands, and in the digestive canal.

Unfortunately in the early stages there are no definite symptoms. In the virulent form young pigs up to a few months old become suddenly ill, and die after two or three days' illness. Matured, strong pigs, are much more resistant, the disease in them may go on for weeks in a milder form, becoming chronic, so that they can spread infection without themselves being suspected.

The healthy pig, when disturbed, emerges from its retreat alert and ready for action; the sick one hides away, and objects to move, if compelled, crawls trembling from its lair. Ears drop, back arched, tail straight down, belly tucked up, appetite fails, and he ceases to thrive, moves in an unsteady manner from side to side, as if partially paralysed, drops on one side, struggles along on the front feet, but there is no loss of sensibility in the hind quarters, if touched he will indicate pain by a sharp cry.

Diarrhœa of an offensive smelling character may occur early, following constipation, and become bloody from the inflamed and ulcerated bowels.

Sometimes patchy eruptions are seen, and circumscribed claret-coloured discolourations of the skin, and even hœmorrhagic patches—readily seen on white pigs—and on the arms, belly, or thighs of black pigs.

Sticky discharges occur from eyes and nose, accompanied by occasional cough; and when the lungs are affected there is panting, breathing, and cough, on being driven.

Pigs are subject to pneumonia in various forms, from cold and exposure in confinement, and when travelling; but in swine-fever of a virulent type, the diseased lungs are usually found associated with ulcers in the bowels. This combination places beyond all doubt the nature of the disease.

The inflammation of the bowels may be diphtheritic or ulcerated, without any disease in the lungs. Then the persistent diarrhœa is the prominent symptom.

To examine the intestines the parts must be turned inside out and washed, then diphtheritic deposits of a dirty-white colour are seen on inflamed patches, beneath this small ulcerations may be detected, and in more advanced cases, distinct ulcers about the size of a threepenny or sixpenny coin, single or running into each other. These are most frequently found in the largo intestines, in the cœcum or blind gut, near the illeo-cæcal valve—that is the commencement of the small bowel. More rarely ulcers are scattered from the stomach, right throughout the bowels.

This disease is not caused by filthy surroundings, or it would have been well known in this State, but it is due to an infected micro-organism, easily transmitted by discharges from one pig to another.

It is useless to doctor sick pigs, because survivors or convalescents would be able to communicate infection for weeks, and perhaps, months, after apparent recovery.

To eradicate the disease every sick pig should be promptly destroyed, and the others slaughtered.

Piggeries should then be thoroughly cleaned, all litter and dirt burnt, sties, fences, walls, floors, drains, troughs, and implements, should be most thoroughly disinfected with fresh made lime-wash, a 5 per cent. solution of carbolic acid mixed with it, applied with a hose or spray-pump. The pens, sties, and paddocks should not be used for pigs for two or three months.

This disease is peculiar to swine, so that poultry, ducks, calves, or sheep may use the pig enclosures without fear of contracting disease.

## ANGORA GOATS.

IN the few cases in which small flocks of Angora goats have been tried in New South Wales the results have been fairly satisfactory. In the *Agricultural Gazette* for September, 1901, Mr. R. A. Blaxland, of Murinbin, near Singleton, afforded readers a great deal of information concerning the management of Angoras and as to their effectiveness in keeping down suckers and scrub. It is possibly on account of their browsing habits that the introduction of Angoras in large numbers to pastoral properties will be undertaken.

The advent of the Angora goat as an American farm animal was received with more or less hesitancy and doubt by the live-stock interests of the United States. For nearly forty years the animal received very little attention from anyone but the few far-seeing enthusiasts whose faith in the suitability of the Angora for establishment in the great arid belts of the western United States never wavered. Then within just the last few years interest in Angoras was fully aroused, and so speedily has the industry progressed that, according to the last estimate of Dr. Bailey, there are now very close upon half a million Angoras in the United States, with Kansas claiming the lead. The adaptability of the animal to climatic and pasturage conditions has been solved in the interest of real merit, and the Angora is to-day safely herding on the herbage and vegetation that is produced in the various sections of the United States. Where the sheep thrives there the goat is in its element. It goes even farther, and makes a good living in the brush and wooded lands, being a great forager on waste places, grown to weeds and brush.

What the expansion of the Angora goat industry will be remains yet to be seen. The utility of the fleece must in a great measure determine this. The goat has found a place in the mutton market, its meat so closely resembling in character that of the sheep that the expert even cannot discern the difference.

This may be so in some isolated cases, but is scarcely likely to be generally applicable for city markets. Nevertheless a well-nourished goat, which is about the cleanest feeding, as well as the healthiest of quadrupeds, should be more wholesome than scraggy old ewes and stags.

But there are many things to be taken into account when the goat is set up as a rival of the sheep—the extent of the demand for the fleece, and the price that will be maintained for it. The goat is a light producer of fleece (mohair), and it necessarily requires a much higher price for the product to make the goat an equal with the sheep in fleece production. The meat of the goat must become equally popular with that of the sheep; all prejudice against goat meat must be removed, so that goat meat will be as popular in the open meat markets of the country as mutton. The feed conditions both in grazing and in winter feed have demonstrated that the goat in small flocks is equal to our common sheep. Whether or not the goat will go in flocks of thousands with equal success has not been fully demonstrated.

Some reliable data in relation to this last fact should be forthcoming within a few years from the State of Missouri, where in the Ozark timber and brush districts the largest Angora ranch in the world is being established. The directorate of the company responsible for this enterprise comprises some of the leading ranchmen of several important States. The area of land secured is 30,000 acres in extent, and it is proposed to run 35,000 goats. As the goats eat at the underbrush the big timber will be cut and disposed of, until ultimately the ranch is cleared ready for conversion into orchard sites. A packing-house for the slaughter of goats is to be established in Kansas City.

In an address before the National Live Stock Association, Dr. Bailey, of California, expressed the following opinion as to the place the Angora goat occupies in agricultural and pastoral worth:—"For years the western breeders have been carefully herding their flocks on alternate ranges that they might save the brush from total extermination, but only recently has this browsing instinct been put into practical use on the farm. To-day many brush-covered pastures throughout the Middle West and East, which had become practically waste land, are covered with blue grass, and are supporting herds and sheep, all because the Angora goat has gone before and blazed the way. It takes two years for the Angora to destroy the brush; the first year he eats all of the leaves which are within his reach, provided there are enough goats for the amount of brush, and some of the brush dies; but the hardier varieties will sprout again the next year, and the Angora must go over the ground, doing his deadly work and fertilising the soil so that grass may grow. Live-stock breeders know that any animal must be properly cared for if he is expected to be profitable. The idea that an Angora goat requires no sheds, no care, no winter feeding, but only an 8-foot perpendicular fence and a place to run, originates in the mind of the person who has never handled domestic animals. Cattle or sheep men would not expect to turn cattle or sheep loose and derive much of a profit from them, nor would they expect to start with a large number of animals of whose habits and requirements they knew little, unless they had an experienced man to care for them. Angora goats do require a perpendicular fence about 36 inches high,* and one which they cannot crawl through or under. They will rarely jump over a fence unless trained to do so. Good, warm, dry sheds are necessary in damp, cold climates, and plenty of freedom and exercise are essential. Low, wet, marshy ground is unfit for goat pasture, and the beginner who makes the greatest success with goats will commence with a comparatively small number of selected animals, whose habits and whose welfare he considers. Goats do not interfere with the pasturage of cattle or sheep, as the Angora is a browser, and not a grazer. Some of the central cattle-breeders have discovered that a few goats in a cattle pasture will keep weeds and brush down and the fence lines clean, and that they make their winter living out of the excess of food which the cattle leave. Far be it from the mind of any goat-breeder that the Angoras have come to take the place of cattle or sheep. His mission in thickly settled regions is to keep the farm in proper condition for other live stock, and in the millions of acres of brush-ridden territory he will act as the forerunner of other branches of the live stock industry. He is not a creation of the whim of speculation, brought from distant Turkey, to induce the American public to part with its hard-earned lucre, but he is a money-maker, and when the American live-stock breeder prepared proper place for the right kind of Angora, he need feel no hesitancy in stocking with these silver-fleeced brush destroyer; they are an American institution, and they have come to stay."

## PHASEOLUS BEANS.

THE Scientific and Technical Department of the Imperial Institute, London, have recently conducted an investigation into the nature of the poisonous constituent of the beans of *Phaseolus lunatus* of Mauritius. These beans have proved fatal to animals as well as to human beings, and the result of the inquiry is to show that they contain a considerable quantity of a glucoside capable of furnishing prussic acid. The beans somewhat resemble the ordinary haricot or kidney bean in shape, though they are usually rather smaller; they are light to dark brown in colour, with red or purple markings.

Several specimens of beans, said to be imported from India under the names of "Paigya Beans," "Burma Beans," and "Red Rangoon Beans," have lately been received from manufacturers and dealers in feeding-stuff in this country, and have also been examined. These are all, undoubtedly, species of the *Phaseolus*; and, although they are not all quite so poisonous as the Mauritius variety, it would seem very undesirable to employ them as a feeding-stuff, at any rate in an uncooked state.

---

* It is possible that this is a misprint.

## RAPE FOR PIGS.

THE results of an elaborate series of experiments conducted at the Wisconsin Agricultural Experiment Station, U.S.A., in connection with the use of rape as a fodder for pigs, are reported to warrant the following conclusions:—

1. That with pigs from four to ten months old representing various breeds, an acre of rape, when properly grown, has a feeding value, when combined with a ration of corn and shorts equivalent to 2,436 lb. of a mixture of those grain feeds and a money value of nearly £4 per acre.
2. That rape is a better green feed than good clover pasture, the pigs fed upon the rape having made on the average 100 lb. of gain on 33·5 lb. less grain than was required by the pigs fed upon clover pasture.
3. That pigs are more thrifty, have better appetites and make correspondingly greater gain when supplied with a rape pasture in conjunction with their grain feed than when fed on grain alone.
4. That a plot of Dwarf Essex forage rape when planted in drills 30 inches apart, early in May in Wisconsin, will yield three good crops of pasture fodder in a favourable season.
5. That rape is the most satisfactory and cheapest green feed for swine that has been fed at the experiment station.
6. That every feeder of pigs should plant a small field of rape adjoining the pig yard, and provide himself with a few rods of movable fence to properly feed the rape to brood sows and young pigs.
7. That rape should be sown for this purpose in drills 30 inches apart to facilitate the stirring of the ground and cultivation after each successive growth has been eaten off.
8. That pigs should not be turned on a rape pasture until the plants are at least 12 to 14 inches high, and that they should be prevented from rooting while in the rape field.
9. That *rape is not a satisfactory feed when fed alone* when it is desired to have any live weight gain in pigs, though it has been found that they will just about maintain themselves without loss of weight on this feed alone.

While under the conditions of Wisconsin, rape proves most valuable as a spring sown crop, the month of May there being equivalent to September here, it will generally be found in New South Wales at its best as an autumn-sown crop which will come on in the winter, and carry animals over a trying stage. For feed in spring and early summer it is questionable whether there is any pasture crop that can be grown in New South Wales equal to lucerne. Every man who keeps pigs should endeavour to have a little patch of lucerne. But it is necessary to remember that the lucerne patch will not stand grazing for too long a stretch at once, and that there will be months in the winter when it simply stands still in spite of irrigation or anything else. It is for those periods that rape comes in so handy. As pointed out in conclusion 9, rape alone is not a complete food, but the same applies to nearly every crop. The first principle of profitable feeding of every class of animals is judicious diversity of fodder, and that can only be attained by providing in addition to any single crop another, and perhaps, more concentrated form of food. On farms where maize is extensively grown it very often happens that the land after the maize is harvested lies idle for perhaps months. If such areas could be seeded with rape, which can be done at an extremely moderate outlay for seed and labour, the pig-carrying capacity of the farm would be enormously increased, while the land would be actually in better heart for the next season's cropping by reason of the improved condition of the soil as a result of the deep-rooting habit of rape, and by the cessation of the profitless drain of weed growth as well as by the addition of the droppings of the pigs. By the time the pigs have to be taken off, it is scarcely likely that they will be mud fat, but they will be, under anything like decent conditions of season, in good robust store condition and ready to benefit rapidly from any well-devised topping-off menu that can be provided for them.

In the business of pig-raising, whether it be for butcher's pork or for bacon-curing, a very important matter for consideration is the stage of growth at which the greatest meat-return is to be obtained from the minimum amount of concentrated foods such as grain or milk, which represent a considerable money value as products of the farm, or of stuff like pollard or meals that have to be purchased.

If, when the topping-off process begins, the pig is taken off a run that has never yielded for the animal depastured on it a sufficiency of frame-building food, or out of a pen where by reason of the expense or shortness of supplies pigs have just existed from weaning, a good deal of the costly food that ought to be producing pork worth, say, 3d. or 4d. a lb., is going to complete a necessary but nevertheless profitless part of the work of building up the animal, which could and should, as a matter of economy, be done with much cheaper materials. Everyone knows how much more expensive it is to fatten up a horse that has been allowed to get "crow poor" than one which has always been kept in fair condition. The same applies to pigs. Of course, it is quite possible in certain cases and by the use of various foods to rush on the fat, but it cannot be done without extra expense and when the produce is marketed it comes under the second grade on account of the flabbiness of the lean and the unattractive oiliness of the fat. The same fault is to be found with pigs that have been confined in pens and fed fattening rations from infancy. In fact, so far as the ordinary pig-farmer's pocket is concerned, it is difficult to know whether insufficient exercise and preponderance of fat-producing food from infancy to market is not more disastrous than the principle of letting the pigs live on sand and wind until a month before they are marketed. The happy and the remunerative medium lies in the provision of cheaply grown crops that the young pigs can harvest themselves. In the gathering of their daily food they will get all the exercise essential to healthy growth, and when they come to undergo a course of better food they will be able to assimilate and thrive on it without all the colics and the unthriftiness that are the price of impaired constitution.

An obstacle in the way of wider adoption of the depasturing of pigs on cultivated crops appears to be in the idea that expensive or elaborate fences are required to keep the pigs within bounds. Where the fence is an ordinary three-rail, two barbed wires—one between the lowest and middle rail and the other midway between the bottom rail and the ground will keep them perfectly secure; on a lanky two rail fence perhaps three barbed wires will be required, but generally a couple—the lowest 4 inches from the ground will do. Of course, if the pigs are kept in the paddock until every particle of feed is consumed they will make extraordinary efforts to get out, and so they may if they do not occasionally get a mouthful of something by way of a change of diet. On most farms in the districts where pig-farming is most generally undertaken there is all the year round some sort of odd scraps and culls accumulating that might just as well be carted out to the pigs as allowed to lie around and waste.

## STORING POTATOES.

The walls and floors should be white-washed, or brushed over with a solution of carbonate of potassium. Fumigating the store by burning sulphur with all openings closed is to be also recommended.

The manner of preserving potatoes in silos (which for large quantities is more practicable than keeping them in cellars, as that would necessitate large buildings) differs little from what has already been described. They must always be protected from humidity, heat, and cold, and have a plentiful supply of air for respiration.

The silos are built of stone, are either sunk below or placed on the surface of the ground. These latter are most frequently used as they are the simplest and preferable to underground ones, in which the tubers are easily liable to heat.

They should be built in a perfectly dry place, either level with the ground or dug down 12 to 16 inches. The tubers are generally placed in prism-shaped heaps, with trapezoidal sections, and tops rounded off. They are then covered with a layer of straw, and afterwards with earth to a thickness of 6 to 8 inches. This is increased when frost sets in, and is taken from open trenches dug round the silo in order to drain it. The draught channels intended for ventilating purposes are made by placing vertically in the heap, every 3 or 4 yards, faggots or stakes, wrapped with rye straw, and reaching 8 or 9 inches above the top. These bear inverted flower-pots as caps to prevent the rain from penetrating the interior of the pile. Square wooden chimneys with holes perforating the sides, and wrapped with straw during cold weather, will serve the same purpose. These ventilators should be closed on the approach of strong frosts, and opened again as soon as the weather permits.

One objection to this system of ventilation is that it induces rot in the tubers nearest the openings, and this spreads by degrees to the interior of the heap. In order to prevent this a certain German agriculturist (M. Miersdorf) has invented a very simple process, the description of which we borrow from M. Wagner (*Journal of Agriculture*, 1896).

"Take two pine stakes of a certain thickness, and a little longer than the upper ridge of the silo. Fix them by some cross-pieces, one thick and one thin end together, but leaving a space of 1½ to 2 inches between them.

"Then place this apparatus longitudinally on the upper surface of the silo. Put pads of straw in the middle and at both extreme ends in order to obtain a ventilating channel of equal height throughout, and nearly horizontal between the stakes.

"Afterwards both stakes and heap are covered with a thick layer of straw, and on this is placed a layer of earth about 4 inches thick. This is beaten hard and smooth to form a sharp ridge.

"The two ends of the stakes project an inch or two at each side beyond the straw and earth cover. By this means we get a channel which gives ingress to the air, and at the same time provides an escape for the vapors which develop in the interior. The channel thus formed is horizontal, and does not admit any rain to enter the inside of the heap."

Several other arrangements are adopted to fulfil the same purpose, all of which may give good results, provided they follow the conditions previously indicated.

The processes of preservation which we have described leave the potatoes intact, with all there primitive qualities.

We will not refer to the fermentation silos for potatoes cut up for cattle food, but may mention that Messrs. Vauchey and Marchal have tried an ingenious mode of preserving potatoes to be used for that purpose.

They are placed among a mass of green ensilage, composed of mixed maize and clover, in a silo. The heat produced by fermentation, which often exceeds 70 degrees (centigrade) in the case of a clover mixture, cooks the potatoes, and when taken out of the silo they are flattened and nearly dry.

They dry easily in the air, and become hard, in which state they can be kept an indifferent time.

In order to soften them, make them digestible, and restore all their alimentary value, they need only to be immersed for a day or two in water, when their percentage of moisture will increase from 15 to 20 per cent. to 60 or 65 per cent. M. Aime Girard also advises that beds of straw be arranged in a dry barn on the farm, and the potatoes, treated as above, placed on these beds, but separated by screens, in order to dry them rapidly in a strong current of air, when they will keep for almost any length of time.

The method of preparing potatoes dried after cooking is as follows:—First they are peeled, then cut into slices, and cooked in steam, and afterwards dried on trays in an evaporator. But these are industrial operations which do not concern us. There are other processes for preserving either on a large or small scale, but those now indicated are most applicable to the requirements of farmers.—*Journal de l'Agriculture.*

## PRESERVING EGGS.

So far as eggs for commercial purposes are concerned it is found in New South Wales that cool storage offers the best and cheapest means of preservation, but in ordinary households and in places where it is desired to preserve a limited number of eggs for sale or for domestic use, it is well to be able to adopt some readily-arranged means of keeping them fresh for two or three months.

An egg is never improved by age, but its good qualities may be preserved, almost entirely, by suitable treatment. One of the first points to bear in mind is to gather the eggs from the nests at least once every day. An egg may deteriorate for food purposes in one or two ways: it may change unfavourably by the beginning of the process of hatching, and it may decay through fermentation started at the pores of the shell. Any moisture on the shell hastens the beginning of decay in this way. Egg merchants have used various methods for preserving eggs. These have been chiefly means for preventing bacteria from going through the shells. That is now commonly done by immersion of the eggs in a solution of some sort. The efficacy of the treatment is very much increased if the solution and the eggs can be kept at a temperature of 40 degrees or below. By way of showing what has been done in the question of preserving eggs, Mr. C. G. Freer Thonger gives, in the English *Farm and Home* the following account of experiments made in Germany by 20 different methods. Early in July of last year 400 fresh eggs were prepared according to these methods (20 eggs for each method) to be opened for use at the end of February. Of course a most essential point for the success of preservation is a means of ascertaining the age of the eggs. The specific gravity of fresh eggs is from 1·0784 to 1·0942. If the eggs are put into a solution of 120 grammes (4·23 oz.) of common salt in one litre (1·0567 quarts) of water, the specific gravity of which is 1·073, all the eggs that float in this liquid are not fresh. Only those eggs that sink should be used for preservation. When, after eight months of preservation, the eggs were opened for use, the 20 different methods employed gave the most varied results:—

1. Eggs "preserved" in salt water were all bad (not rotten, but uneatable, the salt having penetrated into the eggs).
2. Eggs wrapped in paper, 80 per cent. bad.
3. Eggs preserved in a solution of salicylic acid and glycerine, 80 per cent. bad.
4. Eggs rubbed with salt, 70 per cent. bad.
5. Eggs preserved in bran, 70 per cent. bad.
6. Eggs provided with a cover of paraffine, 70 per cent. bad.
7. Eggs varnished with a solution of salicylic acid and glycerine, 70 per cent. bad.
8. Eggs put in boiling water for 12 or 15 seconds, 50 per cent. bad.
9. Eggs treated with a solution of alum, 50 per cent. bad.

10. Eggs put into a solution of salicylic acid, 50 per cent. bad.
11. Eggs varnished with water-glass, 40 per cent. bad.
12. Eggs varnished with collodion, 40 per cent. bad.
13. Eggs varnished with lac, 40 per cent. bad.
14. Eggs varnished with "sward," 20 per cent. bad.
15. Eggs preserved in wood ashes, 20 per cent. bad.
16. Eggs treated with boric acid and water-glass, 20 per cent. bad.
17. Eggs treated with permanganate of potash, 20 per cent. bad.
18. Eggs varnished with vaseline, all good.
19. Eggs preserved in lime-water, all good.
20. Eggs preserved in water-glass solution, all good.

The last three methods are consequently to be considered the best ones, and especially the preservation in a solution of water-glass, as varnishing the eggs with vaseline takes too much time, and the treatment with lime-water sometimes communicates to the eggs a disagreeable odour and taste. There is, however, one drawback connected with eggs preserved in a solution of water-glass, viz., that the shell easily bursts in boiling water; this may be avoided by cautiously piercing the shell with a strong needle.

Water-glass can de obtained in tins ready for immediate use, and bearing full directions for the very simple preparation of the solution There must be a great deal of it used nowadays, and from all sides satisfactory results are reported.

## VARIETIES OF THE VINE.

Mr. R. W. HEATHCOTE, of Hursley, Ingleburn, writes:—"To vine-growers the annual report of the Viticultural Expert is naturally interesting, and that for the present year, published in the *Gazette* last season, has that character, although some amusement is evoked by his reference to this country as 'in its teens in viticultural matters.' Over fifty years ago I read an excellent article in Chambers' Miscellany on the vineyards of Camden, and forty years since grew, in common with other vignerons, the Chasselas in the Geelong district of Victoria. The Swiss were the pioneers of the vine industry there, and having been always accustomed to that variety in their native country (for the Swiss summer is very short and the more generous kinds would not have time to ripen), it was naturally a great favourite in their adopted land; but I fail to see any object to be attained by inducing New South Wales cultivators to plant it. It is a most agreeable grape to the taste, but has not a sufficiently attractive appearance to command a fair price as a table grape, while it is hardly worthy of cultivation as a wine grape in a climate sufficiently warm to ripen any of the choicest varieties of Southern Europe. I had some Chasselas here but was glad to graft them out, and on these stocks have had single bunches of Muscats of Alexandria of a weight up to 4 lb. Of course, Chasselas and Black Hambro', as well as several other varieties, can be grown without much fear of anthracnose—a disease which causes the Muscat family to be such a tax on the industry and watchfulness of the husbandman.

"The introduction of La Folle will be welcomed by those who desire to produce a wine for distillation; but a return of 6d. per gallon hardly indicates a sufficient profit to induce its cultivation in Australia.

"In the department of resistant stocks the Viticultural Branch has a field of great usefulness open, and vinegrowers will watch with interest the result of experiments under this head; but some few years must elapse before sufficient data will be obtained on which to build reliable conclusions.

"The cultivation of the vine and its generous products is so attractive that everything which tends to promote it must command widespread interest."

With reference to the Chasselas variety of grapes, the Viticultural Expert explains that in his annual report, and in the article which appeared in the *Agricultural Gazette* of July last, his desire was to bring under the notice of growers of table grapes the Chasselas, not because it is a showy grape, but because of its fragrance and delicacy of flavour for dessert. It cannot be denied that many of the grapes now grown for table are more attractive to look at than to eat. The belief that the Chasselas is grown in Central Europe only because it does not require a sunny climate to ripen well is not quite correct. The Chasselas is grown there because of all its qualities, viz., extremely early maturity and excellent quality of fruit. In the South of France, where the climatic conditions are more akin to our own, there are large plantations of Chasselas grapes for table use. This is notably the case in the district of Villeneuve-les-Magnelone, near Montpellier, and that of Guyotville. In Algeria, which is a hotter country than New South Wales, the Chasselas is largely cultivated for the table, principally in the districts of Tahel.

The Chasselas has never lost its place in Europe in the forefront of high-class table grapes, and it competes successfully with the latest "creations" that are possessed of many attractive qualities, but not enough to displace it.

The variety is ubiquitous in point of climate, and, to a certain extent, in point of soil, although to reach perfection as a table grape it requires light soil. For wine-making (for which purpose it is largely used in Switzerland) the Chasselas will do best in gravelly soils.

Everything seems to be in favour of this variety except the size of the bunches. It is a question whether large bunches are, apart from the purpose of display in a shop window, such a desideratum in table grapes. As to the Folle Blanche variety, which Mr. Heathcote points out will produce wine worth only sixpence a gallon, it must be remembered that the yield of this variety can, under ordinary conditions, be safely reckoned as 1,500 gallons per acre. Fifteen hundred sixpences per acre will, in comparison with many other varieties of wine grapes, be satisfactory; and if the vigneron can turn his hand to distillation of brandy he will be able to attain a very much larger return. There is a considerable opening for locally-manufactured brandy, and the object in importing the Folle Blanche variety was to provide for the requirements of those who intend entering upon the industry.

## KEEPING MOSQUITOES AT BAY.

THE cleanest and most effectual repellant—*i.e.*, material which will keep off mosquitoes—is oil of citronella, which is an extract from a grass, *Andropogon nardus*, primarily used in the manufacture of cheap grades of perfumery. The odour is not unpleasant to most persons, is quite lasting, and absolutely keeps off all kinds of mosquitoes. Protected by this material, I have slept comfortably for an hour on a seashore piazza on an evening when every one else was driven indoors. I have used it since 1897 on all my collecting trips, and no matter how large the swarm of mosquitoes surrounding me in the marshes or in the woods, none ever alighted on any part of my body rubbed with the oil of citronella. Many others have used this material on my recommendation, and in all cases it has proved absolutely effective. It may be liberally applied on the hands and face, or other exposed parts of the body, but should be kept out of the eyes. On very hot days, or when one is perspiring freely, it causes a slight burning sensation on the skin of the face. So much superior is this to anything else known to me, that I do not consider it necessary to mention any of the other mixtures and compounds that I have seen and used.—The State Entomologist, New Jersey, in a report on mosquitoes.

## CANADIAN FRUIT MARKS ACT.

UNDER the Fruit Marks Act, passed by the Canadian Legislature last year, as amended by an Act which received the Royal Assent in May last, all closed packages of fruit intended for sale must be marked in a plain and indelible manner with the packer's name and address before they are taken from the premises where they are packed; the name of the fruit must also be given, as well as a designation of the grade of fruit, which shall include one of six marks. Fruit of the first quality is to be marked No. 1, or XXX; fruit of the second quality, No. 2, or XX; and fruit of the third quality, No. 3, or X; but the said mark may be accompanied by any other designation of grade, provided that designation is not inconsistent with, or marked more conspicuously than, the prescribed mark. No closed package of fruit must be marked "No. 1" or "XXX," unless such fruit consists of well-grown specimens of one variety, sound, of nearly uniform size, of good colour for the variety, of normal shape, and not less than 90 per cent. free from scab, worm holes, bruises and other defects, and properly packed. Packing in which the faced or shown surface gives a false representation of the contents of the package is also prohibited. Should an inspector under the Act find that a package is falsely marked or packed, he is required to mark the words "Falsely Marked" or "Falsely Packed" on the package, after notifying the packer.

## DISTRIBUTION OF PHYLLOXERA-RESISTANT VINE STOCKS.

THE attention of vine-growers is directed to the following price list of phylloxera-resistant vine stocks for the forthcoming season.

Applications for stocks will be received by the Department of Agriculture up to 31st May, 1903. As it will probably be impossible to supply all applications in full, it has been decided that preference will be given to the applications of those vine-growers within the phylloxera affected portions of the Counties of Cumberland and Camden.

Department of Agriculture, Sydney.

### PRICE LIST OF PHYLLOXERA-RESISTANT STOCKS DELIVERED AT BROCKLESBY RAILWAY STATION AND (BY PARCELS POST) AT HOWLONG POST OFFICE.

| | *ROOTLINGS for Present Planting.* | | | *CUTTINGS for Nursery Stocks.* | | |
|---|---|---|---|---|---|---|
| | Per | | | Per | | |
| | 50 | 100 | 1,000 | 50 | 100 | 1,000 |
| Riparia Grand Glabre ... ... | 2/- | 3/6 | 25/- | 1/6 | 2/6 | 15/- |
| Riparia Gloire de Montpellier ... | 2/- | 3/6 | 25/- | | | |
| Rupestris Martin ... ... ... | 2/- | 3/6 | 25/- | | | |
| Rupestris du Lot ... ... ... | 2/- | 3/6 | 25/- | | | |
| Rupestris Metallica ... ... ... | 2/- | 3/6 | 25/- | | | |
| Riparia x Rupestris, 3,306 ... ... | 2/- | 3/6 | 25/- | | | |
| Riparia x Rupestris, 3,309 ... ... | 2/- | 3/6 | 25/- | | | |
| Riparia x Rupestris, 101$^{14}$ ... ... | 2/- | 3/6 | 25/- | | | |
| Solonis Robusta ... ... ... | 2/- | 3/6 | 25/- | | | |

NOTE.—These vines are not grape-bearing, but stocks on which grape-bearing varieties should be grafted in order to make them withstand phylloxera.

Persons applying for these stocks are advised to state nature, texture, and depth of topsoil and subsoil in which it is intended to plant them, so that the sort most suitable to the ground may be supplied.

(Sgd.) JOHN KIDD, Secretary for Mines and Agriculture.

## CONFERENCE OF PASTORAL AND AGRICULTURAL SOCIETIES' UNION.

THE annual conference of the Pastoral and Agricultural Societies' Union was held in Sydney during Easter week. The annual report was adopted. The number of societies comprised in the union was 64. The question of clashing of show dates was well discussed, and a motion was carried appointing a sub-committee to compile a roster of show dates, and that a copy be sent to each affiliated society. The judging question was also gone into. The following officers were elected:—President, Mr. C. H. Dight, M.L.A.; vice-presidents, Messrs. R. Davidson, M.L.A., P. Oakden, R. T. Keys, F. W. A. Downes, and R. H. Lalor; hon. treasurer, Mr. T. C. Worboys; secretary, Mr. J. J. Miller; auditors, Messrs. W. Muggridge and Ernest Carter. A more extended report of the proceedings will be published in next issue.

A CHAMBER of Agriculture was established on 16th April, entitled "The New South Wales Chamber of Agriculture." The objects will be the advancement of all interests affecting all the branches of agriculture. The following officers were elected:—President, Mr. C. H. Dight, M.L.A.; vice-presidents, Messrs. P. H. Morton, P. Oakden, R. T. Keys, and R. Davidson, M.L.A.; treasurer, Mr. J. J. Miller; council, Hon. W. Bennett, M.L.A., Judge Hamilton, Messrs. W. Harris, L. L. Ramsay, M. Brown, W. H. Hall, F. W. Downes, E. Butcher, T. Bragg, H. J. Rumsey, B. Ferry, W. H. Eyres. It was decided that the election of the remaining thirteen members of the council should be deferred until it was known what agricultural societies would join the chamber.

## DAIRY CONFERENCE.

OWING to want of space, an extended report of the proceedings of the above conference has been held over until next issue.

# Market Review.

14 April, 1903.

POULTRY, &c., received at the Government Cold Storage Depôt.

| Date. | Fowls. | Ducks. | Geese. | Turkeys. | Rabbits. | Hares. |
|---|---|---|---|---|---|---|
| 1903. | | | | | pairs. | |
| January ... ... | 766 | 543 | 293 | ....... .. | 7,688 | ......... |
| February ... ... | 7 | 84 | 13 | ........ | 14,918 | 348 |
| March ... ... | ......... | 1,079 | 6 | 59 | 12,943 | 1,464 |
| Totals... ... | 773 | 1,706 | 312 | 59 | 35,549 | 1,812 |

Besides the above, the following were received :—

| | | | |
|---|---|---|---|
| 1903. | | 1903. | |
| January ... | 42 packages butchers' sundries. | January .. ... | 299 cases eggs. |
| February ... | 111 ,, ,, | February ... ... | 84 ,, ,, |
| March ... | 28 ,, ,, | March ... ... ... | 135 ,, ,, |
| Total ... | 181 ,, ,, | Total ... ... | 518 ,, ,, |

POULTRY, &c., delivered from the Government Cold Storage Depôt.

| Date. | Fowls. | Ducks. | Geese. | Turkeys. | Rabbits. | Hares. |
|---|---|---|---|---|---|---|
| 1903. | | | | | pairs. | |
| January ... .. | 48 | 12 | ......... | ......... | 4,600 | 84 |
| February ... ... | 43 | 12 | ......... | ......... | 14,770 | 108 |
| March ... ... | 86 | ......... | ......... | ......... | 10,350 | 156 |
| Totals... ... | 177 | 24 | ......... | ........ | 29,720 | 348 |

Besides the above, the following were delivered :—

| | | | |
|---|---|---|---|
| 1903. | | 1903. | |
| January ... | 75 packages butchers' sundries. | January ... ... | 162 cases eggs. |
| February ... | 97 ,, ,, | February ... ... | 188 ,, ,, |
| March .... | 4 ,, ,, | March ... ... ... | 344 ,, ,, |
| Totals ... | 176 ,, ,, | Total ... ... | 694 ,, ,, |

Wholesale market quotations, Sydney are :—

Wheat—5s. 3d. per bushel.
Flour—£12 per ton.
Oats—Milling, 3s.; Tasmanian feed, to 2s. 10d.; New Zealand, 2s. 10s.
Maize—Local, to 4s. 9d.
Barley—Feed, 4s. 3d.; malting 4s. 5d. per bushel.
Bran—1s. 2d.; pollard, 1s. 5d. per bushel.
Chaff—to £6 15s. per ton.
Oaten hay—to £7 per ton.

Lucerne—Hunter River, £4 10s. ; extra choice, £5 per ton.
Potatoes—Tasmania, Circulars best, £3 10s. per ton.
Onions—Victorian, to £3 5s. per ton.
Butter—Pasteurised, 1s. 0½d. ; prime, 1s. per lb.
Eggs—1s. 6d. per dozen.
Cheese—Choice, 8d. ; medium, 7½d. per lb.
Bacon—10d. ; flitches, 9½d. per lb.
Hams—In cloth, 1s. 1d. ; New Zealand, 1s. 6d. per lb.
Poultry—Fowls, to 3s. 6d. ; roosters, to 4s. 6d. ; ducks, to 4s. 6d. ; geese, to 6s. ; turkeys, to 7s. ; gobblers, to 13s. per pair.
Honey—Choice, 3½d. per lb.
Lemons—Choice, £1 ; good, 17s. per double case.
Oranges—American, 14s. ; Italian, 10s. per half case.
Apples—Local, to 5s. 6d. ; Tasmania, to 7s. per half case.
Pineapple—Large, 8s. ; common, 7s. per acre.
Bananas—Queensland, to 3s. 6d. per bunch ; 8s. to 10s. per case ; Fiji, to 5s. 6d. per bunch ; 12s. to 13s. per case.
Passion-fruit—Prime, to 12s. per gin case.
Grapes—White, to 4s. 6d. ; black Hamburg, to 4s. 6d. per box ; Muscatels, to 5d. per lb. ; Adelaide, to 7s. per box.
Quinces—Choice, 5s. ; Victorian, 7s. per gin case.
Pears—Local choice, 5s. ; Tasmanian, to 5s. 9d. per gin case.
Plums—Tasmanian, to 3s. quarter case.
Persimmons—to 4s. per half case.

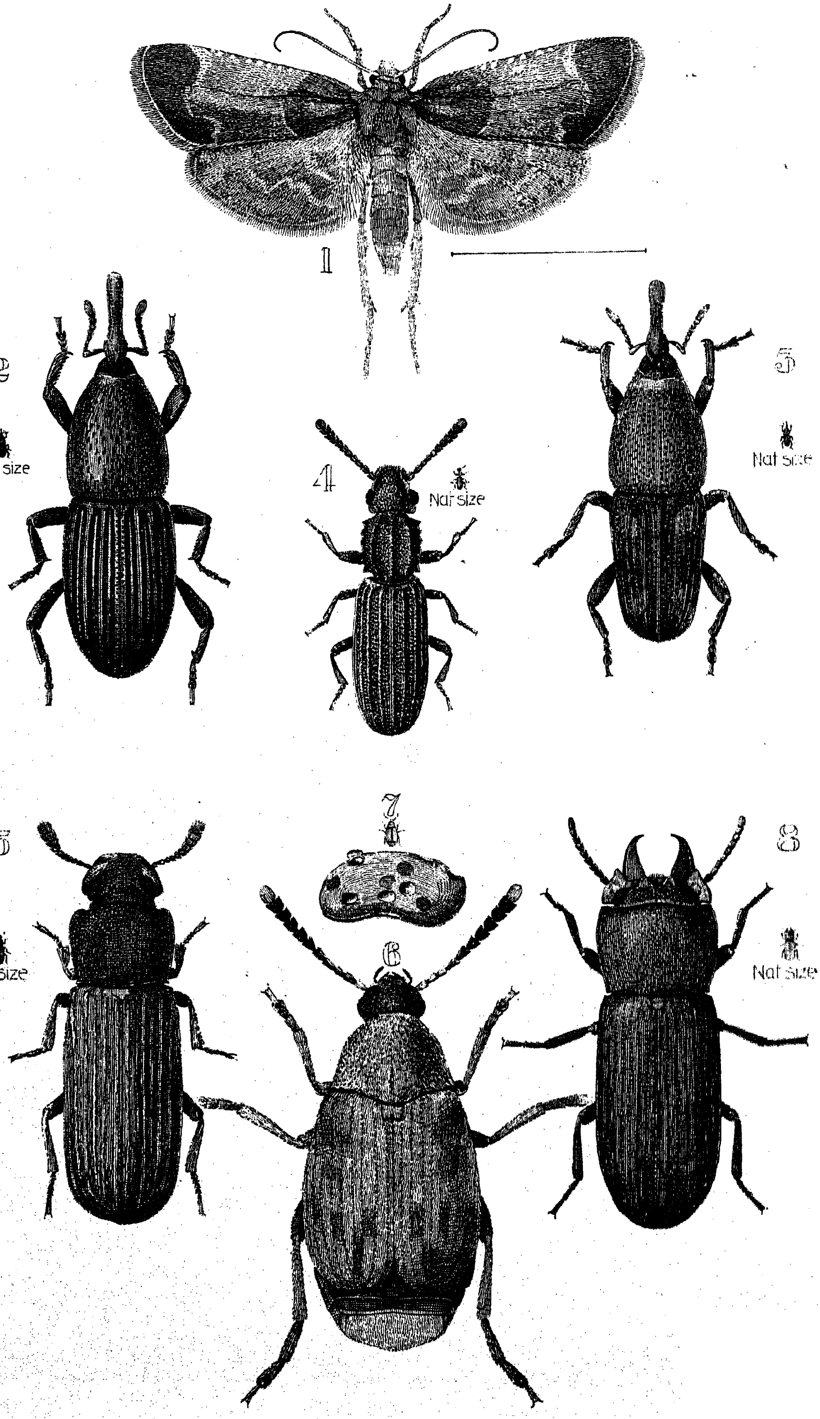
H. V. JACKSON,
Secretary, Board for Exports.

ALTHOUGH the albumen or white of the egg has its hundred and one uses, with and without admixtures with other substances, yet there is none so peculiar as that of mixing eggs with the mortar for building purposes. Lime and the white of an egg is used for mending broken china, earthenware, and glass. The large use of sand, lime, beer, and eggs for mortar is described by Mr. William Andrews in his extracts from the churchwardens' accounts of Rotheram, and the items are interesting, the entries respecting the use of ale and eggs being numerous. Hawkins, in his Antiquities of Westminster, 1807, quotes from a tract on Charing Cross, in which it was stated that it was so cemented with mortar made of lime, sand, white of eggs, and the strongest wort, that it defied all hatchets and hammers whatsoever. The accounts for the re-edifying of St. Mary's spire, Shrewsbury, include this entry: "Forty gallaunds of the best worte are charged at sixpence per gallaund and three shillings for eggs."

## AGRICULTURAL SOCIETIES' SHOWS, 1903.

| Society. | Secretary. | Date. |
|---|---|---|
| Bega Agricultural, Pastoral, and Horticultural Society. | J. Underhill | Mar. 4, 5 |
| Braidwood P. and A. Society | G. F. Taylor | ,, 4, 5 |
| Liverpool A., H., and I. Society | J. E. Wilson | ,, 4, 5 |
| Tenterfield Intercolonial P. A. and M. Society | E. W. Hoskin | ,, 3, 4, 5 |
| Tenterfield Fair Days | ............ | ,, 6, 7 |
| Berrima District A., H., and I. Society | J. Yeo | ,, 5, 6, 7 |
| Bombala Exhibition Society | R. M. Cook | ,, 10, 11 |
| Campbelltown A., H., and I. Society | A. R. Payten | ,, 10, 11 |
| Central New England P. and A. Assoc. (Glen Innes) | Geo. A. Priest | ,, 10, 11, 12 |
| Quirindi District P., A., and H. Society | Geo. Naughton | ,, 11, 12 |
| Tumbarumba and Upper Murray P. and A. Society | J. J. McAlister | ,, 11, 12 |
| Port Macquarie and Hastings District A. and H. Society | J. Y. Butler | ,, 12, 13 |
| Nepean District A., H., and I. Society | E. K. Waldron | ,, 12, 13 |
| Goulburn A., P., and H. Society | J. J. Roberts | ,, 12, 13, 14 |
| Gundagai P., A., H., and I. Association | A. Elworthy | ,, 18, 19 |
| Blayney A. and P. Association | H. R. Woolley | ,, 18, 19 |
| Castle Hill and District A. and H. Association | R. H. Lalor | ,, 18, 19 |
| Inverell P. and A. Society | T. P. Borthwick | ,, 18, 19, 20 |
| Armidale and New England P., A., and H. Association (Armidale) | W. H. Allingham | ,, 18, 19, 20 |
| Camden A., H., and I. Society | C. A. Thompson | ,, 18, 19, 20 |
| Crookwell A., P., and H. Society | C. T. Clifton | ,, 19, 20 |
| Newcastle and District A., H., and I. Association | M. A. Fraser | ,, 19, 20, 21 |
| Castle Hill and District A. and H. Association | R. H. Lalor | ,, 20, 21 |
| Liverpool Plains (Tamworth) A. and H. Association | J. R. Wood | ,, 24, 25 |
| Gulgong A. and P. Association | G. E. Hilton | ,, 25, 26 |
| Orange A. and P. Association | W. Tanner | ,, 25, 26, 27 |
| Macleay A., H., and I. Association | E. Weeks | ,, 25, 26, 27 |
| Walcha P. and A. Association | S. Hargrave | ,, 31, April 1 |
| Cooma Pastoral and Agricultural Association | C. J. Walmsley | April 1, 2 |
| Mudgee Agricultural Society | Joseph M. Cox | ,, 1, 2, 3 |
| Upper Hunter (Muswellbrook) P. and A. Association | P. Healy | ,, 1, 2, 3 |
| Royal Agricultural Society of N.S.W. (Sydney) | F. Webster | ,, 8 to 16 |
| Hunter River (West Maitland) A. and H. Association | W. C. Quinton | ,, 21 to 24 |
| Bathurst A., H., and P. Society | W. G. Thompson | ,, 22, 23, 24 |
| Dungog A. and H. Association | Chas. E. Grant | ,, 29, 30 |
| Wellington P., A., and H. Association | A. O. Rotton | ,, 29, 30 |
| Richmond River (Casino) A., H., and P. Society | E. J. Robinson | ,, 29, 30, May 1 |
| Wellington P., A., and H. Association | A. E. Rotton | ,, 29, 30 May 1 |
| Upper Manning (Wingham) A. and H. Association | W. Dimond | May 6, 7 |
| Clarence P. and A. Society | Jas. C. Wilcox | ,, 6, 7 |
| Hawkesbury District Agricultural Association | C. S. Guest | ,, 7, 8, 9 |
| Lower Clarence Agricultural Society (Maclean) | Geo. Davis | ,, 12, 13 |
| Nyngan and District P. and A. Association | R. E. Burns | ,, 19, 20 |
| Cobar P. and A. Association | J. M. Scott | June |
| Hay P. and A. Association | G. S. Camden | July 23, 24 |
| Riverina P. and A. Society (Jerilderie) | W. Elliott | ,, 28, 29 |
| Narrandera P. and A. Association | J. F. Willans | August 5, 6 |
| Corowa P., A., and H. Society | E. L. Archer | ,, 11, 12 |
| Parkes P., A., and H. Association | G. W. Seaborn | ,, 12, 13 |
| Grenfell P., A., and H. Association | Geo. Cousins | Sept. 2, 3 |
| Junee P., A., and I. Association | G. W. Scrivener | ,, 2, 3 |
| Northern Agricultural Association (Singleton) | C. Poppenhagen | ,, 2, 3, 4 |
| Young P. and A. Association | C. U. Ellerman | ,, 8, 9 |
| Albury and Border P., A., and H. Society | Walter J. Johnson | ,, 9, 10 |
| Yass P. and A. Association | W. Thomson | ,, 10, 11 |
| Cootamundra A., P., H., and I. Association | T. Williams | ,, 16, 17 |
| Cowra P., A., and H. Association | F. H. Piddington | ,, 23, 24 |
| Temora P., A., H., and I. Association | W. H. Tubman | ,, 29, 30 |

[1 plate.]



INSECTS WHICH DAMAGE WHEAT AND OTHER FOOD STUFFS.

1. *The Meal Moth (Asopia farinalis, Linn.)*
2. *The Wingless Grain Weevil (Calandra granaria, Linn.)*

5. *The Confused Flour Beetle (Tribolium confusus, Duv.)*
6. *The Bean Weevil (Bruchus obtectus, Say.)*

*Agricultural Gazette of New South Wales.*

# Insects that damage Wheat and other Foodstuffs.

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

THE enormous amount of cereals and other foodstuffs that are annually destroyed or rendered unfit for human consumption by the infestation of a number of small moths and beetles is almost incredible, and in this State alone, in money value, would run into many thousands of pounds if statistics were available; but they are not, for the millers and merchants seldom say anything about their losses, and a great deal of more or less infested grain is ground up, weevils and all. I had a pickle bottle half full of weevils left at the office, taken from a consignment of New Zealand malt, that was said by my informant to be a fair sample of the lot, which all went into beer.

When it is capable of demonstration that with ordinary care in the construction of buildings intended for store-houses, the greater part of this waste could be avoided, it is astonishing that so little attention is paid to preventive measures.

In the country districts, where large stacks of grain sometimes remain for a considerable time awaiting removal, the local millers and dealers simply construct sheds with a view to protection against the weather, so that mice, weevils, and all kinds of vermin run riot, and much of the stock is infested before it is used or even despatched to the seaboard. The difficulty with the grain warehouses in the city is often in the want of height or ventilation, and it was recorded in London many years ago that rice from India stored in low buildings developed weevil very much more rapidly than when the same shipments were placed in more lofty granaries. At the present time more than half the stores are homes and breeding-places for all such insects. A little attention to cleanliness would work wonders in checking these pests; but how often does one see an absolutely clean mill or produce store? If inquiries are made, one is told that it is a waste of time fighting against weevil and moth, for long before the wheat shows any signs of them, it will have been disposed of, and that it is only when stocks are held over that there is any danger of a loss. When, however, stocks are unavoidably held over the season, it would certainly pay to take some precautions, and not, as is now so frequently the case, throw away hundreds of bags that are perfectly spoilt, being not even fit for fowl-feed.

In America, where the conditions are very similar to ours, a great eal of attention has been paid to the cleansing and fumigation of ills, and extensive premises are regularly treated with fumes of isulphide of carbon, 1 lb. of bisulphide being sufficient to destroy ll insect life in 100 bushels of grain. The stuff to be treated is imply heaped up on the floor, a tube pushed down through the centre f the mass, into which the fluid is poured, a sheet being then thrown ver the lot for the night. The only precautions necessary are that o lights be allowed into the chamber, and on the following morning he grain is turned over, and the remaining fumes dissipated.

If prompt measures are taken when the weevils first show up among he bags, by running all the infested stuff through a winnower, all the beetles and dirt can be blown out, bagged up and burnt, and though the grain may be more or less damaged, the fresh broods of insects re checked, and the grain, even if deteriorated in value, is still worth something.

Several millers have informed me that if the bags of grain or flour are stood on end when stacked, they resist the attack of all pests much better than if stacked on the flat. It is also a well known fact that if clean grain is placed in a salt-bag, no weevil will infest it. The question then arises, could not the corn-sacks be dipped in brine and dried before being used in the harvest field; the cost would not be much, and though the salted corn-sack might be liable to absorb a certain amount of moisture from the atmosphere, it would not be sufficient to injure the grain enclosed.

In the course of investigations into the cause of "bleached or soft wheat" in the north-western portion of this State, the writer collected from millers, dealers, wheat-buyers, and farmers, a great number of samples of all kinds of wheat, which were afterwards kept in stoppered jars for upwards of two years under exactly the same conditions, with the result that nearly all the samples taken from the mills and stores developed weevil and other insects within the first year, while nearly all that taken from farmers' bags has remained free from weevil up to the time of writing—a space of exactly two years. Therefore, though in some cases, now that these wheat pests are so widely distributed about farmyards, they may become infested in the farmers' barns, yet as the bagged wheat is generally carted direct to the railway for sale or storage, it generally arrives at its destination clean, and the town mills and stores are responsible for the pests. In maize growing the conditions are very different, and where it has been grown for many years in a warm climate, like our northern rivers district, much is infested before it is gathered. There are some very curious ideas among wheat-growers that the moth among the grain is another stage of growth of the weevils; but the moths and beetles are quite distinct pests, though all come into the wheat in the same manner, through the parent beetle or moth laying her eggs in or among the seeds. Neither moth nor weevil can grow or develop without the egg being [illegible]t placed in the grain, and though to all outward appearance it may [illegible] perfectly sound, every other grain may contain an egg, and [illegible]n thus for months, before the larvæ appear, and they will work a long time in the shelter of the grain before they are noticeable. Though so many people will tell you that they grow out of the embryo of the grain, there is no such thing as spontaneous generation; there must be an egg before there can be a moth or beetle.

Experiments have been carried out in America as to the action of bisulphide of carbon upon the germinating powers of wheat, and it has been proved that it can be exposed for thirty-six hours without injury, and for twenty-four hours without spoiling it for milling purposes. As before stated, 1 lb. of bisulphide will treat 100 bushels of wheat, and in a reasonably-close building, 1,000 feet of cubic space. In America 1 lb. of bisulphide costs 10 cents; so that 1 ton of wheat can be fumigated for 10 cents. Here the expense is more, as bisulphide is dearer.

In the "Indian Museum Notes," Vol. 1, the following extracts are given from the Annual Report, 1888-89, of the Bhadgaon Experimental Farm in a summary of the results:—

(1) The soft varieties of grains, such as wheats and jowari, are attacked with weevil sooner than hard varieties.

(2) That bisulphide of carbon is a perfect preventive against the attacks of weevil upon grain; that its action lasts in cases not hermetically closed six weeks, after which period a fresh charge of the reagent is required; that even in samples which have been attacked with weevils the effect of bisulphide is immediately felt, the weevils disappearing *en masse*, while this chemical does no harm to grain as regards its colour, smell, and cooking properties.

It goes on to state that on account of its smell there is no danger of the natives harming themselves by using this chemical, and that after treating all the grain and dismantling the old granary very little weevil was found. "It is therefore fair to conclude that painting the interior of the grain houses with poisonous paint and charging the grain with bisulphide (in the proportion of 1½ lb. of the reagent to a ton of grain) will reduce the damage caused by weevils to wheat and other grains to a considerable extent."

## Bleached Wheat and Weevils.

About two years ago, in consequence of the statements made in the Press that wheat-buyers would not buy for export wheat grown in the north-western districts of this State, on account of the quantity of "bleached wheat" among it, and the bad keeping qualities of such bleached wheat, which was destroyed by weevil very much sooner than other kinds, I was instructed to visit some of the chief wheat-growing centres to inquire into the truth of these statements, and also to discover the cause of bleached wheat. During my investigations I stopped at Tamworth, Manilla, Gunnedah, Narrabri, Warialda, Moree, Inverell, and Glen Innes, where I visited a number of mills, granaries, stores, and farms, where the owners gave me every facility to learn all I could, and placed all their information at my disposal. The consensus of opinion is that most of the softer kinds of wheats are subject to bleaching if it is a wet harvest. Strippers and harvesters e universal in these districts, and, therefore, the crop must be dead pe before it can be taken off; if, as is often the case, showery weather ets in just at this critical time, the wheat in the ears may be wet and ried several times before it can be placed in the bags, and by the ction of rain and sun loses its bright healthy yellow tint, and takes n the dull pale tint of "bleached wheat," which is discernible to nyone after the difference has been once pointed out. Buyers can ell at a glance, and fight shy of these soft, bleached samples.

There is not the least doubt that such classes of wheat are more subject to weevil than the hardy varieties; and when they come into the city stores, kept through our close, muggy summer, they are the first to be attacked by all wheat pests. Though there is always some bleached wheat in the north-west, the bulk of the wheat in the districts visited by me appears to me to be as good as that grown in other parts of the State, and many samples collected from the farmers' bags, and placed in stoppered jars in the office in Sydney, and at the Insectarium at the Hawkesbury College, remained perfectly sound and good for over twelve months.

### *The Winged Rice Weevil* (*Calandra oryzæ*, Linn.)

Originally a native of the Orient, it has been known for some centuries in India as a rice pest, and many cargoes of rice arrived in European ports rendered worthless from the infestation and damage caused by this beetle. Chittenden says: "It is a serious pest in the Southern States, where it is commonly though erroneously called "black beetle," but further north is of less importance. It occurs, however, in every State and territory in the Union, and occasionally invades Canada and Alaska."

It has been well established in all the grain-growing districts of Australia for many years, and causes an immense amount of damage to wheat and maize in all parts of New South Wales, but particularly in the north and north-western districts. Curtis, in his "Farm Insects," has described the two grain weevils in detail. The chief points of difference are that in mature forms (for when the beetles first emerge from the pupal state they are often very light-coloured) this species, which is about the same size, or a little larger in some cases, is of a general lighter reddish-brown colour, with the punctures on the thorax much finer, and four irregular light-brown blotches on the wing covers, beneath which are a *well-developed pair of wings*, by which it can sustain a flight to a considerable distance. The parent beetle does sometimes infest maize while in the field, but seldom, if ever, wheat before it is bagged; so that in most cases it is in the granary that the weevils obtain access to their food. Like many other beetles belonging to this family, these pests are long-lived, and the period of egg-laying lasts for some time. In the case of a grain of wheat the weevil gnaws a hole into the side of the grain with the sharp jaws with which the tip of the snout is armed, and then deposits a single egg in the cavity. The germination or development of this egg into a larva, and from that into a beetle, may be retarded for months under certain conditions, but let the wheat be stored in warm, badly-ventilated, or low-roofed grain stores, and the birth and growth of the baby weevil is very rapid. Chittenden says: "It has been estimated that one pair will, in the course of a year, produce 6,000 descendants."

When attacking maize, several eggs are generally laid inside a grain, which contains enough food to support more larvæ than the wheat grain. In some samples of wheat enclosed in screw-topped jars, after being kept for twelve months, 970 grains of wheat yielded 460 weevils, all of which were in the grain in the grub state when it was placed in the jar.

Some wheat from Manilla, N.S.W., was laid on an open tray on the table of the Insectarium at the Hawkesbury Agricultural College, Richmond, and remained perfectly sound for over twelve months, only becoming weevily after the beetles were introduced into the room with some infested maize.

In the vicinity of towns in wheat-growing districts, where wheat that has become weevily is bought by farmers for fowl feed, and where the whole place in consequence becomes infested, it is quite likely that this weevil, with its well-developed wings, will (if it has not yet acquired the habit) fly into the paddock and infest ripening wheat or harvested wheat in the stack. The danger of infesting the farmyard or field through the introduction of spoilt wheat could be got over by either fumigating or subjecting the wheat to heat or steam.

### *The Wingless Grain Weevil* (Calandra granaria, *Linn.*)

Though the common brown wheat pest is usually called the "grain weevil," it is the one described by Linnæus under the name of *Calandra oryzæ*—that is, the universal pest—so that it is somewhat of a misnomer, and this species is a comparatively rare beetle, without the same powers of distribution as it is without the powers of flight. It is somewhat larger than the former, of a uniform brown colour, without the yellow blotches on the wing covers, and the punctures on the thorax deeper and more distinct.

I have met with it for the first time for over a year in a packet of maccaroni left at the office, which was purchased at a Sydney grocer's, though some other maccaroni obtained in the suburbs contained only the former species.

### *The Confused Flour Beetle* (Tribolium confusus, *Dav.*)

This little beetle is chiefly met with breeding in flour, and all the flour stored for any length of time at the homesteads in the western country, among the squatters and farmers, becomes full of this beetle, so that in the "out back" stations, where the cook does not trouble to sift the flour, the damper has a decidedly spotted appearance when cut, in consequence of the presence of the number of these dead flour-beetles that have been cooked in the baking. This rather annoys the fastidious "new chum" when he first commences station life out west, but the old hands used to say: "Put the jam on thick and you won't see them."

All the samples of flour obtained in the west contained the smooth, slender maggot-like larvæ of this beetle, which, in the glass jars, emerged as perfect beetles in the early summer, and worked their way to the sides, forming a little cavity against the glass in their endeavours to get out.

The beetle is of a uniform reddish brown colour, about the sixth of an inch in length, with the sides of the face expanded and angulated to the eyes, the antennæ thickening out in the internal joints, but not forming a true club. The broad square thorax is finely punctured, and the wing-covers, striated and punctured, covering a well developed pair of flying wings.

The presence of the larvæ of this beetle in infested flour gives it a very unpleasant smell, and causes it to be known as "rotten" among the bushmen.

### *The Slender-Horned Flour Beetle* (Echocerus maxillosus, *Fab.*)

There is no record of this beetle being known as a pest in Australia; but as one specimen has been found among the departmental collections, I place it upon the list. This beetle has the usual reddish brown colour, and measures about the eighth of an inch in length, with a much shorter head than the last species, with a pair of slender curved horn-like processes in front between the eyes.

It is supposed to be a native of tropical America, but is known in the Southern States, where it infests the wheat in the field as well as the storehouse.

### *The Meal-worm Beetle* (Tenebrio molitor, *Linn.*)

This is the common wire-worm of the stables and feed-house, usually found among all kinds of horse-feed—oats, grain, and suchlike.

It was described in this *Gazette*, August, 1900, as having been received from abroad in a package of seeds and bulbs. The slender, shining, brown larvæ were feeding upon the contents, and developed into the perfect beetle in our breeding cages.

As a pest it is not a very serious one, and easily got rid of among wheat. Readers are referred to the former paper for a description of the beetle.

### *The Drug-store Beetle* (Sitodrepa (Anobium) panicea *Fal.*)

There is nothing that the larvæ of this little pest does not destroy, though in much of the leather work, such as boots, shoes, and bags, it is more probably attracted by the paste and paper used in their manufacture. In America it is popularly known as the "Drug-store Beetle," on account of the number of different substances it has been bred from. To show the variety of its tastes, within the last month we have received specimens found in a stick of liquorice, a tortoise-shell comb, a leather bag, and some waste tobacco.

## Parasites.

In several instances where this beetle was obtained among imported material, it was accompanied by a small shining metallic tinted parasitic wasp, which was evidently breeding in the larvæ or pupæ. This was recorded by the writer in his report upon this beetle among boots and shoes (1891). The parasite probably acts as a great check upon the increase of this pest. This Chalcid wasp appears to be identical with a parasite found destroying the larvæ of the grain weevil infesting some rice in Washington, and described by Howard under the name of *Pteromalus calandræ*. There is some doubt as to the identity of this insect, as Ashmead considers it to be identical with one described by Westwood, but is now known as *Meraporus calandræ*. Not only is this remarkable as the only internal parasite of this beetle, but one of the very few that destroy the grain weevils.

### *The Cadelle* (Tenebroides mauritanicus, *Linn.*)

This beetle has been figured and described in this *Gazette* for October, 1898, on which occasion it had been obtained among wheat. It is an interesting beetle which was first recorded from France where the larvæ was known as the "Cadelle." It was described by Linnæus in 1758 under the above name under the idea that it was a species of *Tenebrio*, though it really belongs to a very different family (*Trogositidæ*), and has lately been placed by Sharp in the genus *Trogosita*. Owing to its cosmopolitan habits it has at different times been described under at least nine different names.

Chittenden states that he has found the larvæ to be both carnivorous and herbivorous, but the chief damage done by them is nibbling out the end of each grain of wheat, and thus destroying its germinating powers. This beetle has a very wide range. I have taken it under flour barrels on the north-west coast of Australia and among wheat in Sydney, but it is not very plentiful, as far as my experience has gone. From their large size (compared with other grain beetles) and the fact that the larvæ feed among the wheat, and not in it, they can be very easily killed by fumigation.

### *The Saw-toothed Grain Beetle* (Silvanus surinamensis, *Linn.*)

Most of the members of the family *Cucujidæ*, to which this beetle belongs, are in their natural state found under the dead bark on the trunks of trees, where they feed upon decaying vegetable matter, but some, like this species, have so altered their mode of life that they are found among all kinds of food-stuffs, seeds, and such like, in consequence of which they have been carried all over the world, and are cosmopolitan in their distribution. Several species of *Silvanus* have been described as peculiar to Australia, besides this introduced species, which is very plentiful about Sydney in granaries, mills, and stores.

This is a tiny little creature, only about one-tenth of an inch in length, of a uniform dark chocolate-brown colour, elongate and flattened in form, with the outer edges of the thorax fringed with tooth-like spines, six in number, on either side; both thorax and wing covers finely punctured and marked with parallel striæ.

The larva is an active little wire worm with six legs; it crawls about very easily, nibbling at its food, and when full-grown forms a a loose cocoon, covered with bits of the food in which it pupates. From its small size it is seldom noticed in the earlier stages among wheat or grain, and it is only when the dark-brown beetle begins to run about that the infestation is observed.

### *The Buff-coloured Bean Weevil* (Bruchus obtectus, *Say.*)

Strictly speaking these beetles are not true weevils, but they are all seed-eating beetles, as over three hundred species of the genus *Bruchus* have been described from different parts of the world, and as most of those that are bred out of peas, beans, and other stored seeds are introduced with their food from abroad, it is a matter of considerable difficulty to find the original home of or identify any species that turns up among our seeds, unless one has a large series of named specimens to compare them with, but *B. granarius* or *B. rufimanus* is said by Miss Ormerod to be the common bean weevil of England.

We frequently come across this beetle in the red-coloured French beans sold in Sydney and grown, I am informed, in New Caledonia. Samples of these beans, if kept in stock for any time, soon show signs, if infested, by the round, dark-coloured blotches that show through the outer skin. These are caused by the enclosed beetles gnawing away the substance of the bean beneath the skin when the fully-developed beetle is able to easily make its exit.

The number that will emerge from a small packet of seed is something extraordinary. Out of 29 beans placed in a screw-topped jar early in August, 208 beetles had bred out by the 10th September, one bean having been the home of 16 beetles.

This beetle measures about 1½ lines in length, and is of an uniform dark brown to black tint, but so thickly clothed with fine buff hairs that it is of a dull yellowish tint, so that until it is rubbed it does not show the ground colour; the legs and antennæ, more lightly clothed, are of a reddish-brown colour.

The life-history of these seed-eating beetles is very interesting, because they develop with the seed. The mother beetle punctures the young beans just after the flowers have fallen and deposits the eggs in the tissue, so that the baby weevils growing with the beans in the pod are undeveloped and safe until the crop is harvested. This species comes very near *Bruchus obtectus* described by Say, and differs chiefly in being much larger, more yellow, with the thighs of the legs not shaded with black. According to Miss Ormerod the American beetle has been described under three different names—twice by Say, who called a variety of it *B. obsoletus*, and by Riley, who called it *Bruchus fabæ*, so that ours may be another larger variety. This beetle has been studied in America, and is considered to be one of the worst species, because more beetles will breed out of a single bean, and they also have the uncommon habit of laying their eggs in dry beans, while the larvæ are furnished with three pair of legs, and can crawl about among the seeds.

*Remedies.*—In England some of the bean-growers dress the seed with McDougall's sewage carbolic in the same manner that wheat is treated for smut. Others mix it with blue vitriol, so that the smell of the former remains for some time and protects the beans. Miss Ormerod found that soaking the seeds for a short time in water killed all beetles and pupæ in the beans, the water penetrating through the skin where the larvæ have gnawed it thin, and smothering them. In America bisulphide of carbon has been used with very good results in the same manner as when fumigating wheat.

### *The Meal Moth* (Asopia (Pyralis) farinalis, *Linn.*)

This is one of the oldest and best known of all the flour moths, and as usual is world-wide in its distribution, though probably its native land is Europe. Frequently it can be captured resting against the walls of feed-houses, mills, and stores, in the early summer months. Sometimes it comes into the house in the evening, and may be captured as it flutters around the lamp. The caterpillar feeds upon all kinds of corn, bran, pollard, and flour, hidden in a silken tube matted and coated with particles of the food it is devouring. It is said to remain in the larval state two years before it spins a white silken cocoon and pupates.

The moth is a very pretty little creature measuring about an inch across the outspread wings. The ground colour is yellowish buff to dull greyish yellow mottled with darker brown. The fore wings are blotched with the darker tint at the base and the tip, the latter marbled with grey and hollowed out on the inner edge, with a dull parallel stripe on the hind margin of the wing running into both blotches, so that it leaves a central band of buff in the middle of the front margin of the wing. The hind pair are silvery grey mottled with brown that forms a regular wavy dapple on the inner edges.

### *The Mediterranean Flour Moth* (Ephestia Kuehniella, *Zell.*)

A controversy having been raised in the *Australian Miller* newspaper as to this great pest of the flour-miller being known in Sydney early in 1896, the Agricultural Department took the matter up and inquiries were made, which resulted in one firm sending specimens of the larvæ of a moth that was choking up the grain elevators and other parts of the machinery in a similar manner to that of this moth recorded in other parts of the world. In the July number of the *Gazette* of that year, Fuller recorded breeding out specimens which he identified as this moth; but since that date we have had no records of the damage it does in Sydney. There are no specimens of this moth in the departmental collections, and I should be very much obliged to any of our city millers for some specimens of infested material.

The moth was first discovered in a flour-mill in Germany in 1877, from whence it spread very rapidly, appearing in England in 1886, and was recorded from Canada in 1887, and had spread to California in 1892, and three years later appeared in New York.

It is a somewhat larger moth than the other grain pests, measuring nearly an inch across the outspread wings; the fore pair are pale leaden grey with transverse black markings; the hind wings dirty whitish, semi-transparent, with a darker border (Chittenden). The chief damage that the larvæ of this moth does is in invading flour-mills where they form silken tubes in which they feed, afterwards spinning a cocoon, the flour becoming matted together, and stopping the machinery and belting.

Chittenden says that though it prefers flour, it feeds upon all kinds of food-stuffs, and in California it lives in the nests of the humble bee, and in the hives of the honey bee.

More careful cleansing and fumigation of all infested premises is the only way to get at this pest. There are quite a number of moths in this genus that are well-known pests in destroying food. *Ephestia elutella*, Hb., is known as the chocolate moth; *E. cahiritelle*, Zell., destroys dried currants; and *E. desuetella*, Walk., is recorded from Jamaica as a pest in flour.

### *The Wolf Moth* (*Tinea granella*, Linn.)

In habits and size this moth is like the Angoumois Flour Moth, infesting the wheat in the field as well as the storehouse. It is of a general creamy-white colour, thickly mottled with brown. Among the many different moths bred from wheat and other grains I have not been able to identify this species, nor do I know it in other collections. Chittenden says, "It does considerable damage to stored cereals in Europe, but, as it is not particularly destructive in America, requires only passing notice."

French, in Part III, Destructive Insects of Victoria, gives a coloured plate of this little moth, and a brief description, under the name of "The Wheat Moth," but does not state whether it has been identified as this species.

### *The Compressed-vegetable Moth* (*Plodia interpunctella*, Hb.)

This moth was first bred from a packet of compressed vegetables prepared in a factory near Sydney, and described by me under the name of *Ephestia eutella* in the pages of this *Gazette* in 1898, but further investigations have proved it to be the above moth, known in

America as the Indian Meal Moth. This pest is omnivorous in its tastes, feeding upon dried fruits, flour, meal, and grain of all kinds, and has been carried all over the world in its many food stuffs. It has been bred in great numbers from a sample of wheat sent to me by the late James Stephenson (Secretary of the Board of Exports), with a note that 1,000 bags had been shipped to London, and the wheat was said to have been grown at Coolamon, but there was some doubt about the exact locality. Soon after it had been placed in a jar it was swarming with the caterpillars, and the contents of the jar became so matted together with the silken filaments that they could be lifted out in an almost solid mass, and on examination fully 90 per cent. of the grains were found to have the end containing the embryo eaten out. Numbers of the larvæ were found in bran, and others in a box of dried raisins.

Some grub-infested maize imported into Sydney towards the end of last year also turned out to be infested with this moth. Dr. Jefferis Turner, to whom I submitted specimens of this moth, tells me that it is very plentiful in his stable among the maize.

### *The Angoumois Grain Moth* (*Sitotroga* (*Gelechia*) *cerealella*, Oliv.)

This little moth in general appearance is not unlike a clothes-moth, measuring slightly over half an inch across the outspread wings, and is of a uniform silvery dull yellow colour, with the hind wings light brown, the hind margins of the front and both edges of the hind pair clothed with long yellow plumes.

Wheat infested with the larvæ of this moth has been received from Bingera, sent into the office by Mr. Farrer, and from the sample a large number of moths were bred early in March.

This destructive moth is a well-known grain pest, now almost worldwide in its distribution, and takes its popular name from the fact that it was first noticed in the province of Angoumois, in France, in the year 1760, when it swarmed so thickly over the country, damaging so much grain, both in the field and store-houses, that a famine was threatened. It was introduced into the Southern States of America about 1730, and since has gradually worked northward over the whole of the United States. It attacks stored barley in France; maize and wheat in America; and has been recorded from India and Australia.

The caterpillar feeds within the grain until nothing but a thin shell is left, then spins a fine web inside which it pupates. As soon as the moth can escape she flies into the wheat fields and deposits her eggs (from sixty to ninety in number); within a week the eggs hatch out, and the little larvæ crawling into the ripening wheat bore into the kernel, leaving behind them an almost invisible hole, and emerge as full-grown moths in about three weeks. Chittenden says that as many as eight generations come out in the Southern States, and it is estimated that in six months grain infested by this moth loses 40 per cent. of its weight and 75 per cent. of its farinaceous matter.

## BIBLIOGRAPHY OF PAPERS CONSULTED IN WRITING THESE NOTES.

**Chittenden, F. H.**

1. The More Important Insects Injurious to Stored Grain.
   Year Book of the Department of Agriculture, United States, 1894.
2. The Principal Household Insects of the United States. Chapter VIII. Insects affecting cereals and other dry vegetable foods.
   Bulletin, No. 4 (new series), Department Agriculture, United States, America, 1894, pp. 112-130.
3. Some Insects Injurious to Stored Grain.
   Farmers' Bulletin, No. 45, United States Department of Agriculture, Washington, 1897.
4. The Development of the Mediterranean Flour Moth.
   Proceedings of the Eighth Annual Meeting of the Economic Entomologists, 1896.
   Bulletin, No. 6 (new series), United States Department of Agriculture, p. 85, 1896.

**Curtis, John.**

Farm Insects, London, 1883.
Chapter XI. Insects affecting corn crops.

**French, C.**

The Wheat Moth (*Tinea granella, Linn.*), Chap. LXI, p. 129.
Handbook of the Destructive Insects of Victoria, Pt. III, 1900.

**Froggatt, W. W.**

1. Notes on Insects attacking Dried Fruits, Seeds, and other vegetable matter.
   *Agricultural Gazette*, N.S.W., Pt. X, 1898.

**Froggatt, W. W.**—*continued.*

2. Entomological Notes on Specimens received during 1899.
   *Agricultural Gazette*, N.S.W., Pt. VIII, 1900.
3. Entomological Work and Notes for 1900.
   *Agricultural Gazette*, Pt. VII, 1901.
4. Report upon a Beetle destroying Boots and Shoes in Sydney.
   Technical Education Series, No. 8, 1891.

**Fuller, C.**

1. Insect Pests. The so-called Mediterranean Flour Moth (*Ephestia Kuehniella Zell.*)
   *Agricultural Gazette*, N.S.W., Vol. VII, p. 449, 1896.
2. Miscellaneous Notes. Extracts from Annual Report, 1888-89, of the Bhudgaon Experimental Department of Revenue and Agriculture.
   Indian Museum Notes, p. 201, Vol. I, 1889-91.

**Riley, C. V. & Howard, L. O.**

The Pea and Bean Weevils.
Insect Life, Vol. IV, 1892, p. 297.

**Howard, L. O.**

Annual Report, Department of Agriculture, Washington, United States, America, 1880, p. 273.

**Riley, C. V.**

The American Bean Weevil.
Third Annual Report of the State Entomologist of Missouri, 1871.

**Ormerod, Miss A. E.**

Bean Weevils, p. 4, 1896.
Nineteenth Report of Observations on Injurious Insects and common farm pests.

## FUMIGATING CITRUS TREES IN CALIFORNIA.

In his report on the season's operations the Horticultural Inspector of Pasadena district, California, states that fumigation has been more extensive and thorough this year than ever before. The number of trees fumigated totalled 84,000 as against 90,000 sprayed. The result of this vigorous campaign against scale was that the fruit of the whole district was remarkably clean, one large association having to wash only about half a carload of oranges.

# Unfavourable Opinion by Lord Kitchener and his Officers on Australian Horses in 1902.

ALEX. BRUCE.

In the beginning of 1902, news reached Australia that Lord Kitchener and the general officers in South Africa had expressed a very unfavourable opinion of the recent shipments of our horses, which had up to that time given satisfaction, but the information received with respect to these inferior shipments was too meagre to enable us to make any move in the matter with the view to discover how the falling off in their quality occurred.

In the beginning of this year, however, we received copies of the Report and Proceedings of the Court of Inquiry held, by order of the Commander-in-Chief, at St. Stephen's House, Westminster, S.W., on the administration of the Army Remount Department since January, 1899. The matters which this Court had to inquire into threw a great deal of light upon the cause of the complaint against our horses, and have only to be mentioned to show how very exhaustive this inquiry was.

They were the following:—

1. Whether the purchase of horses at home and abroad has been conducted on the best system for the public service.
2. Whether the officers selected for purchasing remounts at home and abroad were suitable and competent.
3. Whether the arrangements for shipments of the remounts as they arrived at the ports of embarkation were satisfactory.
4. Whether the arrangements for the care of the animals during the voyage were in all respects complete, and whether the conducting officers, veterinary surgeons, and attendants conducting accompanying the ships were competent and satisfactory.
5. Whether in cases where the condition of the animals on landing was found to be unsatisfactory, prompt and sufficient measures were taken to prevent the recurrence of the evils reported.

6. Whether a regular system of reports, detailing whether the proper stamp of animals had been provided for the particular services required of them, was called for as a guidance to the relative value of the various sources of supply.

7. Whether in case of alleged fraud or negligence effective measures were recommended for dealing with those concerned.

8. Whether, in view of the large demand on the Department, proper care was taken to obtain all available information as to sources of supply.

9. Whether allowing for the great strain on the Department due care and ability were shown in dealing with the demand for remounts.

I believe, now that the copy of the report of the proceedings of the Westminster Court of Inquiry has been received, that the faults for which the inferior shipments were condemned need scarcely have occurred at all, for a good many of the horses included should never have been passed and would thus never have been allowed to reach South Africa. See portion 14 of Appendix E to the Minutes of Evidence taken before the Court of Inquiry, pages 258 to 261, of the Report of that Court, which are here reprinted as appendices O, P, Q to this paper, but arranged in three different classes,—I, Transport and Artillery; II, Cavalry; and III, Cobs or Mounted Infantry, and in such form as to show the opinions of the officers called upon to report of the relative merits of the several classes of horses sent from the different countries to South Africa. This is practically grading the horses referred to as regards their value and utility for the service, and as the officers in their reports on the questions submitted to them in a comparatively few cases have expressed an opinion as to the order of merit in which the horses of the country they were reporting on stood, the few instances in which the horses have thus been graded have been taken as a guide and with that and their general opinion, a grade has been struck and will be found under appendices O, P, and Q to this paper to enable the necessary comparison to be made between the countries. This will show where the Australian remounts really stand, and where the limits of prices should have been placed by the Remount Authorities for Australians when instructing their Australian buyers.

Although I would suggest that proper and thorough inquiry should be made into our export horse trade, and to include the exportation of the very inferior horses here referred to sent to South Africa, I would in passing, dwell briefly as I can on one very palpable cause why such inferior horses were sent—the very low prices which the remount authorities authorised their buyers to give (viz., £15 for cavalry and £12 for cobs) when they sent them to this State and

Queensland to purchase. Reference to appendices R and S to this paper will show at a glance that the Remount Department made this mistake and it was a serious one.

As the Australian "Waler" has established and for more than half a century maintained a reputation as a first-class artillery and cavalry horse—the best (except perhaps those from the United Kingdom) in the world, and as it may be said that this is the only instance in which he is reported as having to any extent failed to give satisfaction, it is very necessary that inquiry should be made by us as to the reasons which gave rise to these very unsatisfactory reports; for there is no doubt, coming with the great weight they did, the opinions of Lord Kitchener and his officers not only affected the prices of our horses, but led the remount buyers to purchase an inferior description of horse, and what most affected us, caused our horses to get a bad name,—and that too while Australian remounts are notoriously well bred, and fully maintain their reputation, if a fair price is paid for them.

The prices in this State for Indian remounts from breeders of standing ranges from £20 to £30 at from 3½ to 5½ years old, if only broken to lead, and it could not be expected, where a breeder is not overstocked, as he was when the war broke out in some cases, that really first-class remounts could be bought at the very low limits to which the officers purchasing in New South Wales were authorised to go. In fact, it does not pay to breed horses of the stamp we now find were required by the Imperial Government, and after keeping them until they are 6 years old sell the cavalry horses at even £15 and the cobs at £12, especially considering the long age to which they have to be kept and the risk the breeder has to run.

If the horses condemned by Lord Kitchener had been inspected and passed by a remount officer he would of course have been responsible; for if he found the limits of prices given him, as he certainly would have done, as a rule, too low to enable him to purchase first-class horses—horses such as are bought for India or anything approaching that—he should have written for and obtained authority from his Department to extend the limit of prices until they were at any rate on a level with those of other countries. Had this been done then buyers would have had no difficulty in obtaining a very large number of suitable horses, the class of horses in the whole cargo would have been raised, unsuitable horses would not have been sent to South Africa, as nobody would have bought them when they got there, and the good name of our horses would not have been sullied.

Although what I have already said on the subject of who is to blame for the passing of unsuitable horses refers to the purchasers of the Remount Department, and although they might perhaps occasionally have passed an inferior horse or one wanting in condition, I do not think that in the case of the horses condemned by Lord Kitchener they had been inspected by remount officers in this State prior to leaving Australia. A good many, perhaps 8,000 or

10,000, horses from this State and Queensland were sent to South Africa on speculation, and, therefore, did not, I think, require to be inspected by a remount officer before leaving—only, I believe, on arrival in South Africa; and, as it would seem from the evidence of some of the witnesses at the court of inquiry that the supervision of the speculative importations was much less strict in Australia, on board ship, and in South Africa, than in the case of those in the charge of the officers of the Remount Department and properly qualified veterinary surgeons, it was far more likely that the condemnation applied to some of the horses sent to South Africa on private speculation than to those carefully inspected by a remount officer and properly qualified veterinary surgeon before leaving Australia, and which were under strict supervision from the time they were inspected in Australia until they were handed over to the Remount Department in South Africa, whereas it is questionable if the horses brought there on speculation would have been subjected, in the country from which they came, to proper inspection before being shipped, or to the necessary supervision during the voyage, and while unsold in South Africa, but likely be parted with to some dealer, who would dispose of them, if a satisfactory price could be obtained, to the nearest remount buyer, without his knowing much or anything at all of their history. This is a matter in which, of course, our Government could not interfere, and the responsibility for inferior horses being sent lies entirely between the remount authorities and their buyers; but there cannot be a question that if they had been prepared to give better prices (which they certainly ought to have done), they would have obtained better horses, and a good many of them, while the character of our horses would have been maintained.

I trust that the inquiry suggested will be carried out, for not only is it very necessary that the slur cast upon the reputation of the Australian "Waler" should be removed; but there is no doubt that many of our officers and men who have had South African war experiences could give our breeders information which would be of great value to them. Although there may not at present be a demand for horses in any way approaching that which existed during the late war, there will always be a considerable number of first-class horses required for South Africa and India, both of which are markets where good prices are paid. Every endeavour, therefore, should be made to obtain information with regard to the breeding, feeding, and breaking of horses, which will put our breeders in a position to produce such horses as will meet the requirements of the countries mentioned, as well as those of our own markets. If bred and properly broken, there ought also to be an excellent market in London for high class carriage pairs and other harness horses, hunters, officers' chargers, and park hacks.

## APPENDIX (O).

### *Transport and Artillery.*

SYNOPSIS of the Opinions and Reports by Officers on Transport and Artillery Horses sent from the different countries to South Africa.

| Date. | From whom Opinion or Report. | Nature of Opinion or Report. | Estimate of Order Merit represented in figures 1 to 6. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 |
| | | I. THE BRITISH. | | | | | | |
| 1900.<br>9 March | Field-Marshal Lord Roberts | Artillery and Household Cavalry, I consider English horses suit them best | 1 | ... | ... | ... | ... | ... |
| 3 „ | G.O.C.L. of C., Cape | Request shipment of English omnibus horses, which are most satisfactory | ... | 2 | ... | ... | ... | ... |
| 5 „ | Field-Marshal Lord Roberts | English and Walers preferred for Artillery; English omnibus horses also very good | 1 | ... | ... | ... | ... | ... |
| 2 July | Colonel Birkbeck | Nothing has come up to English draught, notwithstanding change of diet and climate has worked and done better than any | 1 | ... | ... | ... | ... | ... |
| | Colonel Stevenson | If well-bred, well adapted for Artillery in Africa | ... | 2 | ... | ... | ... | ... |
| 1901.<br>11 Dec. | G.O.C., Cape | English horses too heavy | ... | ... | ... | 4 | ... | ... |
| 1902.<br>15 Jan. | Lord Kitchener | English horses too large and heavy | ... | ... | ... | 4 | ... | ... |
| 1901.<br>— Sept. | Lieut.-Col. Darley | English were about the best<br>Average, 2. | 1 | ... | ... | ... | ... | ... |
| | | II. ARGENTINE.—Transport and Artillery. Nil. | | | | | | |
| | | III. AUSTRALIAN. | | | | | | |
| 1900.<br>— March | Field-Marshal Lord Roberts | Glad of well-bred Artillery Walers | 1 | ... | ... | ... | ... | ... |
| 3 Jan. | Lord Birkbeck | Excellent; has been favoured by similarity of climatic conditions | 1 | ... | ... | ... | ... | ... |
| 9 „ | Lieut.-Col. de Lisle | Best in South Africa | 1 | ... | ... | ... | ... | ... |
| 11 „ | Lieut.-Col. Milford | Heavy-bodied bad; lighter built good | ... | ... | 3 | ... | ... | ... |
| 10 „ | Major-General Hutton | Hardy and enduring, better than English | 1 | ... | ... | ... | ... | ... |
| — Dec. | Colonel Birkbeck | Not done at all well; most disappointing; draught horses a scandal<br>Average, 2. | ... | ... | ... | 5 | ... | ... |
| 1902. | Colonel Birkbeck | IV. NORTH AMERICAN.—The information too meagre to grade North American Draught and Artillery horses | Information too meagre to grade Draught and Artillery from these countries. | | | | | |
| | | V. CANADIAN.—The information too meagre to grade Canadian Draught and Artillery horses | | | | | | |
| | | VI. HUNGARIAN.—Good draught horses. Hungarians do not ride | | | | | | |
| | | VII. CROATIAN AND RUSSIAN.—Transport and Artillery. Nil | | | | | | |
| | | VIII. COLONIAL AND BASUTO.—Transport and Artillery. Nil | | | | | | |
| | | IX. BASUTO.—Transport and Artillery. Nil | | | | | | |
| | | X.—INDIAN, COUNTRY BREED, ARABS, EGYPTIANS.—Transport and Artillery. Nil | | | | | | |

## APPENDIX (P).

### *Cavalry.*

SYNOPSIS of Officers' Opinions and Reports on Cavalry sent to South Africa from the different countries.

| Date. | From whom Opinion or Report. | Nature of Opinion or Report. | Estimate of Order of Merit represented in figures 1 to 6. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 |
| | | I. BRITISH. | | | | | | |
| 1899.<br>19 Dec. ... | G.O.C., Cape ... ... ... | Great climatic changes and heavy winter coats have told greatly against them.. | ... | ... | ... | 4 | ... | ... |
| 1900.<br>3 Jan. ... | Colonel Birkbeck ... ... | A commander in the field says: "On no account do I wish for English remounts." | ... | .. | ... | ... | 5 | ... |
| 10 April ... | Major-General French ... | No doubt English horse requires much acclimatising, otherwise he breaks down soon, especially from diseases of the feet. Prefers English horse after "Waler" ... ... ... ... ... ... ... | .. | 2 | ... | ... | .. | ... |
| 15 „ ... | Field-Marshal Lord Roberts | English and Walers preferred for Artillery and Cavalry purposes ... ... | .. | 2 | ... | . | ... | ... |
| 6 May ... | Lieut.-Col. Hon. H. Laurence | Horses good enough; bad condition for remounting; shoeing bad ... ... | ... | ... | 3 | ... | ... | ... |
| — July ... | Colonel Birkbeck ... ... | Nothing has come up to English Cavalry and draught; notwithstanding change of diet and climate, he has worked and stood hardship better than any .. | 1 | ... | ... | ... | ... | ... |
| 22 Dec. ... | Colonel Stevenson ... ... | If well bred, &c.—well adapted for Cavalry and Artillery in South Africa ... | ... | 2 | .. | ... | ... | ... |
| 1901.<br>11 Dec. ... | G.O.C., Cape ... ... ... | English horses too heavy; well bred, weight-carrying pony is the ideal of all mounted troops ... ... ... ... ... .. ... ... | ... | ... | 3 | ... | ... | ... |
| 1902.<br>15 Jan. ... | Lord Kitchener ... ... | Strong and compact well-bred horses are what we require, and Bays horses wrong stamp to last in this country ... ... .. ... ... .. | ... | .. | 3 | ... | ... | ... |
| 22 „ ... | „ ... ... | English horses too large and heavy ... ... ... ... ... ... .. | .. | .. | 3 | ... | .. | ... |
| 1901.<br>— Sept. ... | Lieut.-Col. Darley ... ... | The English horses were about the best ... ... ... ... ... ... | ... | 2 | .. | ... | .. | ... |
| | | Average, 2·72. | | | | | | |
| | | II. ARGENTINES. | | | | | | |
| 1900.<br>— March ... | Field-Marshal Lord Roberts | Cavalry, except Household, prefer Argentines .. ... ... ... ... | ... | .. | 3 | ... | ... | ... |
| — April ... | G.O.C.L. of C. ... | Generals in Field place Argentines in third for Cavalry and Mounted Infantry | ... | .. | 3 | ... | ... | ... |
| 10 „ ... | Lieut.-General French ... | Preferred for Cavalry ... ... ... ... ... ... ... .. | .. | 2 | ... | ... | ... | ... |
| 1900 ... | Lieut.-Col. Hon. Laurence ... | Did not like them ... ... ... ... ... ... ... .. | .. | ... | .. | 4 | ... | .. |
| 1900 ... | O.C. 5th Dragoon Guards ... | Not a success ... ... ... ... .. ... ... .. | .. | ... | ... | 4 | .. | .. |
| 1901 ... | Lieut.-Colonel Darley ... | Survival of the fittest; good ... ... ... ... ... ... | ... | .. | 3 | ... | ... | ... |
| | | Average, 3·1. | | | | | | |

## APPENDIX (P)—*Cavalry*—continued.

| Date. | From whom Opinion or Report. | Nature of Opinion or Report. | Estimate of Order of Merit represented in figures 1 to 6. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 |
| | | III. AUSTRALIANS. | | | | | | |
| 1900. | | | | | | | | |
| 3 Jan. | Colonel Birkbeck | Excellent; have been favoured by similarity of climatic conditions | 1 | ... | ... | ... | ... | ... |
| — March | Field-Marshal Lord Roberts | Artillery glad of well-bred Walers | 1 | ... | ... | ... | ... | ... |
| — ,, | G.O.C.L. of C. | Asks for increase of Australian Cavalry horses | 1 | ... | ... | ... | ... | ... |
| 1 April | Field-Marshal Lord Roberts | Preferred with English with Cavalry and Artillery | 1 | ... | ... | ... | ... | ... |
| 8 ,, | Lieut.-Colonel Pilcher | Would be the best if allowed time | 1 | ... | ... | ... | ... | ... |
| 9 ,, | Lieut.-Colonel De Lisle | Best in South Africa | 1 | ... | ... | ... | ... | ... |
| 9 ,, | Lieut.-Colonel Milford | Heavy bodied, bad; lighter built, good | ... | ... | 3 | ... | ... | ... |
| 10 ,, | Major-General Hutton | Hardy and enduring; better than English | 1 | ... | ... | ... | ... | ... |
| 10 ,, | Lieut.-General French | Preferred for Cavalry | 1 | ... | ... | ... | ... | ... |
| 20 July | G.O.C.L. of C. | Placed first for Cavalry | 1 | ... | ... | ... | ... | ... |
| | Colonel Birkbeck | Have done well; lack recuperative power of English | ... | 2 | ... | ... | ... | ... |
| — Dec. | ,, ,, | Not done at all well | ... | ... | ... | 4 | ... | ... |
| — ,, | G.O.C., Cape | Big horses no good | ... | ... | ... | 4 | ... | ... |
| 1901. | | | | | | | | |
| — Sept. | G.O.C., Cape | Not good stamp; 16 per cent. unfit | ... | ... | ... | 4 | ... | ... |
| 11 Nov. | Lieut.-Colonel Darley | Difficult to ride; suffered most on voyage; took longest to recuperate | ... | ... | ... | ... | 5 | ... |
| 1902. | | | | | | | | |
| 22 Jan. | Colonel Birkbeck | Walers heart-breaking | ... | ... | ... | ... | 5 | ... |
| — Feb. | Lord Kitchener | Badly selected; bad; marked deterioration since September, 1901 | ... | ... | ... | 4 | ... | ... |
| — ,, | Colonel Stevenson | If well selected, the best; 50 per cent. unbroken; most not judiciously selected | ... | ... | ... | ... | 5 | ... |
| — ,, | Lieut.-Col. Hon. Laurence | If given time Walers and English best for Cavalry | ... | 2 | ... | ... | ... | ... |
| | | Average, 2·5. | | | | | | |
| | | IV. NORTH AMERICANS (U.S.). | | | | | | |
| 1900. | | | | | | | | |
| — July | Colonel Birkbeck | North Americans and Canadians show a good deal of breeding; are very docile | 1 | ... | ... | ... | ... | ... |
| — Aug. | G.O.C.L. of C. | North Americans landed in bad condition *ex* "Knight Bachelor" | ... | ... | ... | 4 | ... | ... |
| 8 Dec. | ,, ,, | North Americans better than Canadians | ... | 2 | ... | ... | ... | ... |
| 8 ,, | Colonel Birkbeck | North Americans varied greatly; capital Light Cavalry horses | ... | 2 | ... | ... | ... | ... |
| 8 ,, | G.O.C.L., Cape | Replies to question that North American horses are better for riding than Hungarians | ... | 2 | ... | ... | ... | ... |
| 8 ,, | Colonel Stevenson | Texas horses wiry and easily acclimatized, but subject to soft feet | ... | ... | 3 | ... | ... | ... |
| 1901. | | | | | | | | |
| — May | G.O.C.L., Cape | American Cavalry horses too leggy | ... | ... | 3 | ... | ... | ... |
| 29 Sept. | O.C. Remount Depôt, Port Elizabeth | Americans good and useful Cavalry | ... | 2 | ... | ... | ... | ... |
| 23 ,, | ,, ,, | Kansas and Texas placed second | ... | ... | 3 | ... | ... | ... |
| 21 Nov. | O.C. Remount Depôt, Durban | Americans suitable and in good condition | ... | 2 | ... | ... | ... | ... |
| 1902. | | | | | | | | |
| 7 March | Colonel de Bergh | Two shiploads from the same herd were excellent, and the third was utterly unsuitable | ... | 2 | ... | ... | ... | 6 |
| | | Average, 2·6. | | | | | | |

## APPENDIX (P)—*Cavalry*—continued.

| Date. | From whom Opinion or Report. | Nature of Opinion or Report. | Estimate of Order of Merit represented in figures 1 to 6. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 |
| | | V. CANADIANS. | | | | | | |
| 1900.<br>— July | Colonel Birkbeck | North Americans and Canadians show a good deal of breeding; very docile | | 2 | | | | |
| — Aug. | G.O.C.L. of C. | Canadians too big and slack | | | | 4 | | |
| 8 Dec. | Colonel Birkbeck | Canadians too slack to carry a man, and too light for draught | | | | 4 | | |
| 8 ,, | Colonel Stevenson | Canadians next after English and Irish; apparently well selected | | 2 | | | | |
| 29 Sept. | Lieut.-Colonel Darley | Canadian horses third in order of merit with Hungarians | | | 3 | | | |
| 29 ,, | Mr. Robertson | Thinks Canadians very much better than Texas | | 2 | | | | |
| 1902.<br>19 Jan. | Lord Kitchener | Canadian Cavalry unsuitable; too big | | | | | 5 | |
| 19 ,, | G.O.C., Cape | Commends horses of Canadian Contingent | | 2 | | | | |
| | | Average, 3. | | | | | | |
| | | VI. HUNGARIANS. | | | | | | |
| 1896 | Colonel Tolnor | A bad horse | | | | | 5 | |
| 1900.<br>18 April | Colonel Birkbeck | Arrived looking splendid after being forty days at sea | | | 3 | | | |
| 27 ,, | Field-Marshal Lord Roberts | Asks for small, stout Cavalry horses; Hungarians or Egyptians preferred | | | 3 | | | |
| 27 ,, | Major Sadler Jackson | A good lot | | 2 | | | | |
| — July | Colonel Birkbeck | Well spoken of by Yeomanry; those imported by the Imperial Government have not done well | | | | 4 | | |
| — ,, | Lieut.-Col. Hon. H. Laurence | Did not like them | | | | 4 | | |
| — Dec. | Colonel Birkbeck | Showy; done badly | | | | 4 | | |
| —— | G.O.C.L. of C. | Not so good as Americans | | | | 4 | | |
| —— | Colonel Stevenson | Not useful for Cavalry; soft and deficient of stamina | | | | | 5 | |
| | | Average, 3·7. | | | | | | |
| | | VII. CROATIAN AND RUSSIAN. | | | | | | |
| 1902.<br>29 Jan. | Lord Kitchener | As Cavalry horses, unsuitable. | | | | | | |
| | | VIII. COLONIAL AND BASUTO. | | | | | | |
| 1900.<br>10 April | Lieut.-General French | Small and light; not suitable for Cavalry. | | | | | | |
| | | IX. BASUTO. | | | | | | |
| 10 ,, | Lieut.-General French | Small and light; not suitable for Cavalry. | | | | | | |
| | | X. INDIANS, COUNTRY BREEDS, ARABS, EGYPTIANS. | | | | | | |
| | | These were very much more cobs than Cavalry and have been classed as such. *See* under Cobs. | | | | | | |

## APPENDIX (Q).

### *Cobs.*

### SYNOPSIS of Officers' Opinions and Reports on Cobs sent to South Africa from different Countries.

| Date. | From whom Opinion or Report. | Nature of Opinion or Report. | Estimate of Order of Merit represented in figures 1 to 6. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 |
| 1900. | | I. BRITISH. | | | | | | |
| 8 April | Lieut.-Colonel Alderson | Second in merit, if aged, in condition, and sufficient food available | | 2 | | | | |
| 8 ,, | Lieut.-Colonel Pilcher | Those which were not fit when they left England have fallen away directly they were asked | | | | 4 | | |
| 11 ,, | Major-General Hamilton | Places English in order of merit, bracketed with Australians | | 2 | | | | |
| 10 ,, | Major-General Hutton | Do not become acclimatised for 18 months. Of little value for immediate Mounted Infantry Service | | | | 4 | | |
| 9 ,, | Lieut.-Colonel Milford | Irish cobs have stood the work well, and are thoroughly satisfactory | 1 | | | | | |
| 9 ,, | Lieut.-Colonel De Lisle | If landed in good working condition, they do as well as any class. If off grass in England, they die in numbers | | 2 | | | | |
| 20 ,, | Field-Marshal Lord Roberts | In Mounted Infantry Cobs, English first | 1 | | | | | |
| 19 Dec. | G.O.C., Cape | Irish Cobs are preferred | 1 | | | | | |
| 22 ,, | Colonel Birkbeck | Irish Cobs and English Polo Ponies have both done exceedingly well. Most Commanding Officers prefer Irish Cobs | 1 | | | | | |
| | | Average, 2·0. | | | | | | |
| | | II. ARGENTINES. | | | | | | |
| 1897–98 | Major Gunning | Have done admirably. They are tough and hardy, with a big girth | 1 | | | | | |
| 1899 | O.C. Troops, Natal | Appear most suitable | 1 | | | | | |
| —— | Major-General Sir W. Butler | Look well; but had not the bottom or go of the Cape horse. Require two months in South Africa. Not got heart. Some good | | | 3 | | | |
| — Dec. | G.O.C., Cape | Recommends purchase. Better weight carrier than South Africans | | 2 | | | | |
| 1900. | | | | | | | | |
| Jan. & Mar. | G.O.C.L. of C. | Argentine Cobs proving soft hearted | | | | 4 | | |
| 8 April | Lieut.-Colonel Pilcher | A good animal, but not so good as South Africans | | | 3 | | | |
| 9 ,, | Lieut.-Colonel Alderson | Mostly in soft condition | | | 3 | | | |
| 9 ,, | Lieut.-Colonel Milford | A complete failure | | | | | 5 | |
| 9 ,, | Lieut.-Colonel De Lisle | Not suitable for Mounted Infantry; low bred | | | | | 5 | |
| 10 ,, | Major-General Hutton | Coarse and underbred; useless for military purposes | | | | | 5 | |
| 11 ,, | Major-General Hamilton | Placed 3rd in order of merit | | | 3 | | | |
| — July | Colonel Birkbeck | Quiet, good for slow work, soft hearted, no manners, incapable of effort; generally condemned | | | | 4 | | |
| — Dec. | ,, ,, | Would have done well for Mounted Infantry | | | 3 | | | |
| — ,, | ,, ,, | No one who saw them at the front had a good word to say for them, except the 10th Hussars | | | 3 | | | |
| 1902. | | | | | | | | |
| — Dec. | O.C. 10th Hussars | Asked for them always. Said they were the best | 1 | | | | | |
| | | Average, 3·0. | | | | | | |

### APPENDIX (Q)—*Cobs*—continued.

| Date. | From whom Opinion or Report. | Nature of Opinion or Report. | Estimate of Order of Merit represented in figures 1 to 6. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 |
| | | III. AUSTRALIANS | | | | | | |
| 1900.<br>10 April | Major-General Hamilton | Placed them second in order of merit | | 2 | | | | |
| 20 ,, | G.O.C.L. of C. | Placed them second with English for Mounted Infantry | | 2 | | | | |
| — Dec. | Colonel Birkbeck | Better than horses; nuggets excellent | 1 | | | | | |
| — ,, | G.O.C., Cape | Preferred them | | 2 | | | | |
| | | Average, 1·75. | | | | | | |
| | | IV. NORTH AMERICANS AND CANADIANS. | | | | | | |
| 1900.<br>— Oct. | G.O.C.L. of C. | Asks for 1,050 stout Cobs, preferably American | | 2 | | | | |
| — Nov. | Colonel Birkbeck | All very good, especially Texans | | 2 | | | | |
| —— | G.O.C., Cape | Canadians and Americans preferred | | 2 | | | | |
| 1901 | Colonel Stevenson | Texan were wiry; easy acclimatised; but have soft feet | | | 3 | | | |
| 29 Sept. | Colonel Birkbeck | American Mounted Infantry Cobs, highly commended | | 2 | | | | |
| 29 ,, | G.O.C., Cape | American Cobs are of the stamp preferred to larger horses | | 2 | | | | |
| 27 Nov. | Colonel Birkbeck | Mounted Infantry Cob from United States is wanted by everybody | 1 | | | | | |
| 1902.<br>19 Jan. | Lord Kitchener | American Cobs are good | 1 | | | | | |
| | | Average, — | | | | | | |
| | | V. CANADIAN. | | | | | | |
| 1900.<br>— Nov. | Colonel Birkbeck | Canadian Cobs are very good | 1 | | | | | |
| —— | G.O.C., Cape | Canadian and Australian Cobs preferred | 1 | | | | | |
| | | Average, 1·0. | | | | | | |
| | | VI. HUNGARIANS. | | | | | | |
| 1896 | Colonel Tollner | The small horse, if carefully selected, a useful animal | | | 3 | | | |
| 1900.<br>— Dec. | Colonel Birkbeck | Disappointing; last no time | | | | | 5 | |
| — ,, | R. Vyner, Esq. | The last was a good lot | | | 3 | | | |
| 1901 | Lieut.-Colonel Darley | Placed them third, with Canadians | | | 3 | | | |
| | | Average, 3·75. | | | | | | |
| | | VII. CROATIANS AND RUSSIANS. | | | | | | |
| 1901 | R. Vyner, Esq. | Croatian more suitable than Hungarian | | | 3 | | | |
| 1902.<br>27 Nov.<br>27 Jan. | Colonel Birkbeck | Arrived in first-rate condition; good strong cobs; but cracking up, being unacclimatised | | 2 | | | | |
| 29 ,, | Lord Kitchener | Small Cobs good; Croatian horses unsuitable | | 2 | | | | |
| 13 Feb. | General —— | Small; satisfactory | | | 3 | | | |
| 1902 | V. A. Colonel Quinspel | Does the work of half a dozen Hungarians | | 2 | | | | |
| | | Average, 2·4. | | | | | | |

## APPENDIX (Q)—*Cobs*—continued.

| Date. | From whom Opinion or Report. | Nature of Opinion or Report. | Estimate of Order of Merit represented in figures 1 to 6. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 |
| | | VIII. COLONIAL AND BASUTO. | | | | | | |
| 1900. | | | | | | | | |
| 8 April ... | Lieut.-Colonel Pilcher ... | If in condition, the best of all .. ... ... ... ... ... ... .. | 1 | ... | .. | ... | .. | ... |
| 8 ,, ... | Lieut.-Colonel Alderson ... | Placed first, if not too poor ... .. ... ... ... ... ... .. | 1 | ... | .. | .. | ... | ... |
| 9 ,, .. | Lieut.-Colonel De Lisle ... | Best Pony for Mounted Infantry work ... ... ... ... ... .. | 1 | .. | .. | ... | ... | ... |
| 9 ,, ... | Lieut.-Colonel Milford ... | The better bred, best of all .. ... ... ... ... ... ... | 1 | .. | .. | ... | ... | ... |
| 10 ,, ... | Major-General Hutton ... | Undoubtedly best ... ... ... ... ... ... ... ... | 1 | .. | .. | ... | .. | ... |
| 11 ,, ... | Major-General Hamilton ... | Placed first in order of merit .. ... ... ... ... ... ... | 1 | ... | . | ... | ... | ... |
| 10 ,, ... | G.O.C.L. of C. ... . | Placed first for use of Mounted Infantry ... ... ... .. ... .. | 1 | ... | .. | ... | ... | ... |
| — July ... | Colonel Birkbeck ... .. | Hardy and quiet; cannot carry great weight; good for Mounted Infantry ... | 1 | . | ... | ... | .. | ... |
| —— | ,, ,, ... ... | Nothing surpasses South African Cobs for Mounted Infantry work ... ... | 1 | ... | ... | ... | ... | ... |
| | | Average, 1·0. | | | | | | |
| | | IX. BASUTOS. | | | | | | |
| 1899. | | | | | | | | |
| — Nov. ... | General M. Clarke ... .. | At that time Basutos would not sell ... ... ... ... ... ... ... | ... | .. | ... | .. | ... | ... |
| 1900. | | | | | | | | |
| — Mar. .. | S. of S.... ... ... ... | Endeavour to top Basuto market ... ... ... ... ... ... ... | ... | .. | ... | ... | ... | ... |
| — Dec. .. | Colonel Birkbeck ... .. | Basutos best of all ... ... ... ... ... ... ... ... | 1 | .. | ... | ... | ... | ... |
| —— | Colonel Stevenson .. ... | Cobs best and hardiest ... ... ... ... ... ... ... .. | 1 | ... | ... | ... | ... | ... |
| — May . . . | Lieut.-Col. Hon. W. Laurence | Local horse best for the country ... ... ... ... .. ... ... | 1 | ... | ... | ... | ... | ... |
| | | Average, 1·0 | | | | | | |
| | | X. INDIAN COUNTRY BREEDS, ARABS, EGYPTIANS. | | | | | | |
| 1900. | | | | | | | | |
| 9 Mar. ... | Field-Marshal Lord Roberts | Rest of Cavalry prefer Indians and Argentines ... ... ... ... ... | ... | 2 | ... | ... | ... | ... |
| 10 April ... | Lieut.-General French ... | Indians small and light, not suitable for Cavalry ... ... ... ... ... | .. | .. | ... | 4 | ... | ... |
| 11 ,, ... | Colonel Le Gallais ... ... | Arabs probably give the best results ... ... ... ... ... ... ... | ... | 2 | ... | ... | .. | ... |
| 11 ,, ... | Major-General Hamilton ... | Places Indians third with Argentines... ... ... ... ... ... ... ... | .. | ... | 3 | ... | ... | ... |
| 9 ,, ... | Lieut.-Colonel Milford ... | Indians good, but cannot stand heat and want of water ... ... .. ... | ... | ... | ... | 4 | ... | ... |
| 10 ,, ... | Lieut.-Colonel Alderson ... | Indians seem flat sided ... ... ... ... ... .. ... ... ... | ... | ... | ... | 4 | ... | ... |
| 10 ,, ... | Lieut.-Colonel Pilcher .. | Indians soft; delicate feeders ... ... ... ... ... ... ... ... | ... | ... | .. | ... | 5 | ... |
| 10 ,, ... | ,, ,, ... | Arabs keep best condition, but unsuited for Mounted Infantry ... ... ... | ... | ... | 3 | ... | ... | ... |
| 10 ,, ... | O.C. 4th M.I. Brigade ... | Indians have done well, but not so well as Colonials ... ... ... | ... | ... | 3 | ... | ... | ... |
| 20 ,, ... | G.O.C.L. of C. ... ... | Arab horses have proved excellent ... ... ... ... ... ... ... | ... | 2 | ... | ... | ... | ... |
| 27 ,, ... | Field-Marshal Lord Roberts | Asks for small, stout horses, Egyptian or Hungarian preferred ... ... ... | ... | ... | 3 | . | ... | ... |
| — July ... | Colonel Birkbeck ... ... | Indians have quickly gone to pieces. Indians soft and too excitable; a poor lot | ... | .. | .. | 4 | ... | ... |
| —— | ,, ,, .. ... | Small Arabs have been excellent; nothing can beat an Arab ... ... ... | 1 | .. | ... | ... | ... | ... |
| — Dec. ... | G.O.C., Cape ... ... ... | Asks for Arabs or Barbs ... ... ... ... ... ... ... ... | ... | 2 | ... | .. | ... | ... |
| —— | G.O.C., Egypt ... ... | Cannot get more than sixty Egyptians a month ... ... ... ... ... | ... | ... | ... | ... | ... | ... |
| | | Average, 3·07. | | | | | | |

## APPENDIX (R).

PRICES taken from the Report of the Court as having been paid for horses purchased, and limits to which the Officers purchasing were authorised to go in the several countries by the Remount Authorities, and also the difference between the prices and limits the Remount Officers were allowed to go in New South Wales and Queensland, and those allowed in the other countries.

| Countries Horses came from. | Prices for Cavalry. | Difference. | | Prices for Cobs. | Difference. | |
|---|---|---|---|---|---|---|
| | | Increase. | Decrease. | | Increase. | Decrease. |
| | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. |
| III. Australian ... ... ... | 15 0 | ...... | ...... | 12 0 | ...... | ...... |
| I. British ... ... ... | 45 0 | 30 0 | ...... | 30 0 | 18 0 | ...... |
| II. Argentine ... ... ... | ...... | ...... | ...... | 8 0 | ...... | 4 0 |
| IV. United States ... ... | 25 10 | 10 10 | ...... | 15 0 | 3 0 | ...... |
| V. Canadian ... ... .. | 28 0 | 13 0 | ...... | 25 0 | 13 0 | ...... |
| VI. Hungarian ... ... ... | 30 0 | 15 0 | ...... | 20 0 | 8 0 | ...... |
| VII. Croatian and Russian ... | ...... | ...... | ...... | 26 10 | 14 10 | ...... |
| VIII. Colonial Basuto ... ... | Prices not given. | | | ...... | ...... | ...... |
| IX. Basuto ... ... ... | | | | | | |
| X. Indian breeds, Arabs and Egyptian. | | | | | | |

This shows a difference between the limit of prices fixed by the Remount Department in the case of cavalry between Australian and British horses of £30, and between Australian and other countries of from £10 to £15.

As regards cobs, the limit of prices again was seemingly fixed for Australian cobs at £18 less than British, and in the case of other countries at limits ranging from £3 to £14 10s.

## APPENDIX (S).

ABSTRACT of estimated order of merit of Transport and Artillery, Cavalry and Cob Horses sent from the several countries to South Africa, so far as the necessary information is obtainable from the synopsis of Officers' reports.

| | Transport and Artillery. | Cavalry. | Cobs. |
|---|---|---|---|
| III. Australian ... ... ... ... ... | 2 | 2·5 | 1·75 |
| I. British ... ... ... ... ... ... | 2 | 2·72 | 2 |
| II. Argentine ... ... ... ... ... | Nil | 3·1 | 3 |
| IV. United States ... ... ... ... ... | Nil | 2·6 | 2 |
| V. Canadian ... ... ... ... ... | Nil | 3 | 1 |
| VI. Hungarian ... ... ... ... ... | Nil | 3·7 | 3·75 |
| VII. Croatian or Russian... ... ... .. | Nil | Nil | 2·4 |
| VIII. Colonial and Basuto ... ... .. | Nil | Nil | 1 |
| IX. Basuto ... ... ... ... ... .. | Nil | Nil | 1 |
| X. Indians, Country-breds, Arabs, Egyptians... | Nil | Nil | 3·07 |

It will be seen from this abstract, which is the only test at all reliable which can be made, that—notwithstanding the lowness of the limits of prices allowed the remount buyers in this State, and the neglect in some cases of proper inspection and supervision—our horses, compared with those from other countries, were, if not the best, at least equal to the best, sent to South Africa.

# The Dairy Conference.

THE Conference of Delegates representing the various Agricultural Societies, to consider the Dairy Industry Bill, commenced its sitting in the Queen's Hall, Pitt-street, Sydney, at 2 p.m., on Thursday, 16th April, 1903. There were present:—

The Hon. J. Kidd, Minister for Agriculture (in the Chair);
Mr. W. S. Campbell, Director of Agriculture;
Mr. M. A. O'Callaghan, Government Dairy Expert;

Messrs. Crouch, Tumut and Gundagai;
W. H. Matthews, Cootamundra;
R. Aitkens, Albury;
S. P. Reynolds, Molong;
W. J. McPhillamy, Bathurst;
A. Rothwell, Orange;
J. D. Coudon,
W. C. Grey,
H. O. R. Wilson,
W. Warden,
J. James,
S. M. Cotton,
D. Thorburn,
T. Brown,
A. Hay,
} Dairy Farmers' Union; [without votes.]
F. G. Duncan,
D. McIntyre,
} Factory Manager's Association;
D. Baine, Hastings River;

Messrs. A. A. Loder, Tweed River;
W. W. Brandon,
H. M. Williams,
} Richmond River;
G. H. Varley,
S. A. Small,
} Clarence River;
P. C. Basche, Macleay River;
W. Plummer, Manning River;
R. F. Graham,
W. H. Goodman,
} Hunter and Paterson Rivers
J. F. Chaffey, New England;
T. Brown,
G. Lindsay,
} Illawarra and Shoalhaven;
G. F. Wilford, Milton;
D. Hutchinson, Moruya;
A. L. Manning,
J. J. Collins,
} Bega;
R. McEvilly, } Moss Vale and Robertson;
R. Gibson, Goulburn and Crookwell.

The Hon. J. KIDD (Minister for Agriculture), in opening the Conference, said:—Of course you are all aware of the object of the meeting to-day, it is to discuss the provisions of the "Dairy Industry Bill of 1902." I regret to some extent that the number of delegates could not very well have been made larger than they were, but you can all see that such would have been very inconvenient in many ways. Of course, there are many present to-day who are not accredited delegates of the groups of societies who were to elect delegates, and while I am very pleased to see them present as visitors, and to join in the discussion, they will not be able to vote on any decision on any of the clauses of the Bill. However, I should like to hear the opinion of the delegates on this proposed legislation.

I would like to say that I rather regret that a meeting took place the other day at which it was carried that those present did not want any Dairy Bill at all. It was said they did not want any supervision or inter-meddling in any way with regard to the proposed legislation. I regret very much indeed that that should have taken place at this time. If they were desirous of considering the question fairly and fully, why did they not say "We had better go to the Conference, and hear what they have to say." This would have been a better course than to have carried a resolution in favour of rejection of any proposed legislation. To say the least of it, it did appear unseemly. It was action taken in order to prevent fair deliberation, and conclusions being arrived at as to any necessary legislation. I make these remarks because the gentlemen who were present committed themselves, and I think should have stayed outside, and not come to the Conference already pledged to oppose it. It is due to the Conference to say that these gentlemen should not have committed themselves so hastily, and on the eve of this Conference, I think it was altogether wrong.

I will read the notes I have put together, which will be more explicit than I could very well address myself off-hand on a Bill of this character.

The present Dairy Bill is, practically speaking, a copy of the New Zealand Dairy Industry Act which has been found to have worked with such success in that Colony. Owing to many of the clauses having been misunderstood the Bill did not, generally speaking, receive the support it deserved from the dairy farmers. It would be impossible to draft a Bill of value to the industry which would not hurt somebody's corns, and, no doubt, the key to a considerable amount of the opposition which the Bill had received was explained in that morning's *Herald*, where it was pointed out that 50 per cent. of the butter exported from New Zealand last year was purchased by English merchants direct from the factories. That meant that those commission agents who made their profits by the commission which they obtained for exporting the butter to be sold again by English commission houses lost the percentage which they got for exporting that butter, and, of course, they would do everything in their power to prevent anything which would bring about a direct loss to their company. (Hear, hear.) The New Zealand Act had evidently brought the producer into closer touch with the consumer by eliminating the profits of the middleman, and it should be to the benefit of the dairy farmers of this State if a similar condition of things existed here. From the published reports of our Commercial Agents in England, it would seem that the New Zealand system of grading butter was highly favoured by English merchants, who were now enabled to buy without seeing the butter, with perfect confidence that they would receive a first-class article, carefully inspected by an official who had no monetary interest in misrepresenting the quality. (Hear, hear.) This system of grading had now been in use in New Zealand for some years, and the dairying industry had gone ahead by leaps and bounds, also the reputation of the butter exported from that Colony had risen to first place among all colonial butters. As showing the growth of the industry in New Zealand, in 1896 the value of the butter and cheese exported amounted to £373,191, while in 1902 the exports were valued at £1,173,216. Surely any system of inspection and grading under which an industry made such progress as that must be beneficial to that industry and to the State as a whole. (Hear, hear.) Its great advantage was that it enabled the officials to find out at once what factories are making inferior butter, and to send an official there to consult with the manager, and endeavour to put matters right. The New Zealand system of grading had, of course, this advantage, as well as the advantage of guarantee to the purchaser that he was getting an article of the quality demanded; and, as had been pointed out by Mr. Lance, after a careful inquiry into the matter in England, this New Zealand system facilitates business, and gives confidence to all who handle New Zealand butter. In New Zealand butter is graded at eight different ports, so that the expense of grading would be very considerably more in that country than in this, where they had but one port from which butter was exported to England. (Hear, hear.)

It was not intended to interfere with the present cold-storage arrangements of Sydney for dairy produce by erecting a Government building. There was already plenty of cold-storage accommodation in Sydney for all the butter they were likely to produce for some time. Competition for the English market was becoming keener every year, and now the Argentine and Siberia had entered as new and serious competitors with Australia in supplying butter for the English winter trade. There was plenty of room for first-class butter on English markets, but second-class was only wanted at a very low price, such as that obtained for Siberian butter. The Danes had also increased their exports to England, as had many other European countries. This, together with the fact that cold-storage accommodation had been made so perfect at many English centres, enabling thereby the summer butters to be held over for winter use, made it absolutely necessary that if this country was to hold its own, only freshly-made butter of first-class quality should be exported. The manufacture of second-class butter for export would be ruinous to our dairy farmers. During the past year very little butter has been exported, and as a consequence factories have become more lax in the grading of cream, with the result that a considerable portion of the butter manufactured had been inferior. In a year of plenty this butter would have to be exported, with the result that very low prices would be obtained and the reputation of New South Wales butter would be considerably damaged. Perhaps one of the best illustrations I could give of the ill effects of shipping inferior butter to England under a first-class brand, would be to quote the experience of the United States of America in this respect.

It was a well-known fact that the great pork trade of America had been built up under Government supervision; samples representing all pork exported being examined microscopically by officers of the American Department of Agriculture. That acted as a guarantee to all purchasers, and a few years ago when there was an outcry against American pork in Germany, the American Department forcibly pointed out that the health and quality of their product was guaranteed by a thorough system of Government inspection. The Department also sent an officer to Germany to enquire into alleged causes of complaint, and so successful had been the supervision of pork and grain exported from the United States that in the Annual Report of the Department of Agriculture for 1898, it was strongly advocated that the system of Government supervision be also applied to dairy products, and in the report of that Department for the following year, supervision was still more strongly advocated, and the remarks there made were very applicable to the present state of things in this country. It was shown that the experimental exports of dairy products made during the last two years and now in progress under special provision of law had produced marked results, and, the report continued:—"The new markets opening for our dairy products require a guarantee of the purity and quality of butter and cheese sent from the United States, such as is given by other Governments, and especially Canada. Not long ago this country supplied and practically controlled the cheese market of Great Britain. But, as no system of export inspection existed to guard the established reputation, unscrupulous merchants exported great quantities of inferior adulterated and counterfeit cheese until the reputation of the United States cheese was destroyed in England and that market lost to us. Canada, on the other hand, adopted a system of Government control, and was enabled to guarantee all cheese exported as pure, of standard quality, and thus secured and still holds the desirable British markets which this country lost. The best cheese now exported from this country goes through Montreal, seeking the good company of Canadian cheese and finding a market virtually as a part of that product."

If legislation were not introduced into New South Wales they would, before long, be sending their butter to New Zealand and forwarding it Home under that Colony's cover. The same unfortunate results seem likely to follow the efforts to export fine creamery butter to Great Britain unless measures are promptly taken to avoid it. A new and profitable demand for fine creamery butter had scarcely begun before large quantities of an inferior article and also of imitation creamery butter began to appear among the exports. "This article, which is more dangerous and damaging to creamery butter than even margarine, was sent to New York by the car-load for export. In at least one instance renovated butter had been put up in the style of package adopted by the United States Department in its export trials to England, and this went abroad labelled 'Finest American Creamery Butter.' Meantime Canada is forging ahead with Government supervision and guarantee to assist in securing for its creamery butter a firm hold in the British markets. I recommend as a simple and effective remedy for these growing evils and obstacles in our export trade that the existing system of Government inspection and certification of meats and meat products for export be extended by law so as to include dairy products. This inspection of dairy products for export has been endorsed by all the National and State dairy organisations in this country, and has met with decided approval by commercial bodies and by individual exporters wherever it has been duly considered."

The case in New South Wales at the present time was, practically speaking, similar to that dealt with in that report. (Hear, hear.) There was no supervision of exports, and there was nothing to prevent the very worst butter in the State being exported as "Finest New South Wales Creamery Butter." That had been done in the past, and had helped materially to injure the reputation of the State on British markets. It was seen how easily America lost hold of her great cheese trade with England, and the dairy farmers of this State would do well to carefully consider whether they were not also risking the loss of the reputation which it had taken years to build up. Their butter had to take on the average second place to New Zealand and Victoria on the British markets, and there was no valid reason for that. As good a butter could be made, and was made in some instances, by the factories of this State, as that produced in any part of the world, and there was no better evidence of that than by the high quality of the butter exhibits which were made for show purposes. Those exhibits were specially made from selected milk and cream collected under the most cleanly conditions, with the result that the produce turned out was extra fine, and it was only last November that they learned that the butter exhibited by one of the factories of this State at the London Exhibition had carried off first prize. (Applause.) What they wanted was that the bulk of the butter should be made under the same careful conditions as were those exhibits specially manufactured for show purposes.

There was no use in sending an English grocer a special sample of, say, five boxes of butter, made from selected cream, and then when he ordered a large quantity sending him butter made from all qualities of cream mixed together. They must be able to supply butter of a high quality and in large quantities if they were not to lose their place entirely on the British markets. That would never be done until there was a stringent system of grading cream adopted by all factories. At the present time factories were powerless to grade cream thoroughly, as, has been pointed out, they could not afford to lose their customers. Some of the very large factories were, no doubt, powerful enough to grade their cream pretty strictly, because, if even 10 per cent. or 15 per cent. of their suppliers went to other factories, they would still have enough left to manufacture enough butter to enable them to keep the expense of manufacture within normal limits. For the last three or four years the country had been waiting on the factories to grade the cream; but, instead of making progress, the grading of cream had, during the past year, gone backwards. Many factories who had adopted it were, by force of circumstances, compelled to abandon it until such time as an inspection of export products would compel all factories to grade their cream. It was stated by some that by grading butter they were beginning at the wrong end, but it should be unnecessary to point out that immediately the butter was graded it would compel the factories exporting butter to grade their cream, and that would bring about a more regular delivery of cream, and hence a cream of a better quality. It might also be pointed out that if it be deemed necessary to grade cream, the Bill has power to do so. (Hear, hear.) Delegates should realise the magnitude to which the industry would probably grow. There was, perhaps, more dairying country in New South Wales than in New Zealand, and producers would have to look to the Home market for their returns. To maintain a high standard, and ensure the English buyer, they must adopt different means than hitherto. Once export began on a large scale—and there was no reason why it should not reach a value of two or three millions sterling annually—greater care and cleanliness must be exercised. In their own interests farmers should see that they had proper supervision. (Applause.)

At the request of the Minister, Mr. O'Callaghan read an explanation of the various clauses of the Bill, which was as follows:—

Since the Bill was introduced into Parliament, some slight amendments have been made by the Minister for Agriculture, and in submitting the Bill to the Conference it will be noticed that these amendments have been made on the margin, so as to enable delegates to see the Bill as it now stands. In addition to this, owing to the fact that so many of the clauses in the Bill have been misunderstood, the following explanations of how the various clauses will work are here given.

Clause 3, it is noticed, repeals the Dairy Supervision Act, but it has been decided that the repeal clause shall not include the cities of Sydney or Newcastle. This Bill is intended to deal more with the country than with the city, and the clauses that affect the city, as far as we are concerned, will be the parts of the Act referring to the sale and export of dairy produce, including margarine.

The definitions call for very little explanation. The word "dairy," it is seen, includes any place in any way connected with dairy produce, so that the stores in which butter is sold, or, in other words, the produce houses, will come in for their share of inspection just the same as the dairy farmer. This is only just, because there would be little use in making a first-class article if it was afterwards stored in an unfit place whereby its quality would be ruined.

The only other definition requiring explanation seems to be "pure milk." Here it is seen that pure milk must not contain less than 3 per cent. of butter fat, or less than 8·5 per cent. of solids. This will, no doubt, come in for some discussion by delegates, and it might be pointed out that this is the standard which has recently been adopted in the British Isles after taking all the evidence possible on the subject. The only thing which seems to suggest itself regarding this matter is that where it can be proved by reference to the cow that the milk obtained therefrom is lower than this standard the penalty should not be inflicted.

### *Registration.*

Subsection 1 of clause 6 states that every dairy shall be registered and that a fee of 2s. 6d. per annum shall be charged. Very few have objected to this small fee, but, it might be pointed out to those who take objection to it that this is a very small charge individually, but collectively it will help to pay for the expenses of grading and inspection, and delegates will note no other charge is made for the services of officers appointed under the Act. Surely if by having properly trained inspectors the industry is benefited to a considerable extent no farmer will object to this small annual fee. At the present time a great portion of the inspection has to be done by policemen, and no matter how excellent these officers may be in their own department it must be remembered that they have had no training in dairying, and hence cannot be expected to give any assistance to farmers.

The question of renewing the registration from year to year has led to considerable criticism and, on consulting the Parliamentary Draftsman on the matter, it has been ascertained that there is no actual necessity to register annually, but that a certificate shall be issued annually to each registered premises, which certificate may be obtained by post without any further trouble on payment of the annual fee. Thus the farmer will have no registration form to fill in unless he changes his premises or discontinues for a time the work of dairying, in which case notice will have to be given so that the registration may be cancelled, otherwise the farmer would still be liable to various clauses of the Act. It will be noted that the penalty for non-registration in case of a dairy proper does not exceed £10, whereas in the case of a margarine factory the penalty may amount to £100. This high penalty is necessary because the profits on margarine are large and if the penalty was a small one a margarine manufacturer might be content to run the gauntlet and thus avoid inspection.

### *Inspection and Sanitation.*

Subsection 1 needs no explanation.

Subsection 2 is also very simple, but it will be seen how necessary it is that the Inspector should have power to examine dairy produce and take samples for analysis, otherwise it would be impossible to detect fraudulent practices, such as the addition of margarine to butter.

Subsection 3 of this clause is one that in some districts has come in for adverse criticism, but it was found when the clause was explained that those who were originally against it strongly supported it. This section is there solely for the purpose of detecting adulteration and misrepresentation. If, for instance, an Inspector has reason to suppose that a merchant sends out margarine in a box labelled "pure creamery butter" he should have the power to follow that box up and take a sample thereof when it arrives at the grocer's or in transit if necessary. Some factories were afraid that an Inspector might stop their butter on the road to the railway and make the driver unload the whole lot for the purpose of taking a sample. It is hardly necessary to point out that a sane Inspector would not adopt such a course unless the load was coming from a margarine factory and that he had reason to suppose the boxes were not branded in accordance with the provisions of the Act.

Clause 8 deals with the defect which an Inspector may order to be remedied and there seems very little in any of the subsections of section 1 requiring explanation.

In subsection (*d*) the word "stock" occurs, and it might be here pointed out that the word "stock" here means cattle or horses.

In section 2 there are two subsections, viz.:—3 and 4 that have been amended.

Subsection 3 deals with diseased stock and the slaughter of same. In connection with this it will be seen that the right of appeal is granted, and where a farmer has reason to believe that a condemned animal is not diseased he may appeal before the ordinary Courts presided over by a Police Magistrate. In cases where an Inspector slaughters an animal which is not diseased the question of compensation arises, and in this case it would be only just that a farmer be allowed the ordinary market value of the animal so destroyed.

With regard to subsection 4, this refers to the right of detaining any dairy produce where it was placed or stored when a sample was taken by the Inspector. This would only be of use in such a case as where an Inspector had cause to believe that a quantity of what was represented as butter, but which he believed to be margarine, was being offered for sale. In such a case it would not do to allow interested people to remove the goods until the analyst had stated that no fraud existed or until an order could be obtained for its confiscation. This subsection would also be of use in the case of infectious disease when it might be ascertained that any store has been the centre from which the disease has been spread, and when it may be necessary to forbid the sale of it, or removal of the goods suspected of spreading the infection.

Clause 9 refers to the condemnation and disposal of dairy produce unfit for human consumption. It is a rare thing to find dairy produce of this character, but still the clause is necessary because such produce may be discovered at any time, and hence the Inspector should have power to deal with it. It would really apply more to cheese than to cream or butter as decomposed cheese is more dangerous than decomposed butter.

Clause 10 sets forth the duties of stock-owners with regard to diseased stock. There does not seem to be anything in connection with this clause that requires explanation. It is a duty which all stock-owners owe to the health of the community.

Clause 11 is also what might be practically called a health clause, and the list of customers referred to in section (*a*) of this clause is only required for the purpose of enabling the source of any contagious disease to be traced.

Clause 12 asks that statistics relating to the output of factories and dairies be supplied to the Minister, and should meet with no objection, as such statistics are now furnished to the Statistician representing the Government.

Clause 13 and subsections thereof are the usual ones with regard to the question of keeping pigs near the dairy, and are similar to the regulations made under the present Dairy Supervision Act.

### *Sale and Export of Dairy Produce.*

We now come to the clauses that have led to the most criticism, chiefly because of a misprint; the word "port" having been used for "ports" in clause 17, which is an exact copy of the clause referring to this matter in the New Zealand Act; the only difference being that the word "port" was misprinted instead of "ports."

Clause 14 points out that dairy produce intended for sale shall not be kept in any room used for domestic purposes, nor any other place calculated to render the produce injurious to health; and this clause will scarcely meet with opposition from anyone interested in the welfare of our dairying industry.

Clause 15 and the subsections thereof deal purely with adulteration, and it is seen that included as an addition in this clause is the use of a half per cent. of boric acid in butter. The regulations provide that the amounts of preservatives used in dairy produce may be regulated under this Act; but, as this Department is of opinion that a half per cent. of boric acid is very useful to our export industry, and as the English Commission came to the conclusion that this amount was harmless, it is now provided for in the body of the Bill.

Subsection 2 in section 1 of clause 15 has been struck out altogether as being unnecessary as it has been provided for in the margarine clauses of the Act.

Clause 16 deals with contaminated and adulterated milk, butter, &c. Part (*a*) of this clause has been altered; the word "tainted" has been struck out because it was misunderstood, and to make it clear, the clause now reads:—"Any milk or cream which is unfit for human consumption." Part (*b*) refers to the sale of milk from a diseased cow, and also to the sale of milk from a cow immediately after calving. It is well known that what are called the "biestings," or milk drawn from the cow for the first three or four days after she has calved, is not fit for the manufacture of butter, and hence it should not be supplied to factories. Part (*c*) has already been referred to in the definition of "pure milk," and part (*d*) refers to the conditions under which condensed milk should be sold. There is no reason why this milk, which competes with our fresh milk, should not be sold in a manner which will be a guarantee to the purchaser that he is obtaining what he intends to purchase. The standard asked for here is really lower than that recently recommended by the committee appointed by the English Board of Trade for the purpose of inquiring into this among other matters. Part (*e*) of clause 16 is rather an important one, because it fixes the standard for butter. Butter which does not contain 80 per cent. of butter-fat will do this State but very little credit, and now that there is a tendency on behalf of some factories to allow as much water as they conveniently can to remain in the butter, it will be well that something definite should be done in this connection. Some may think that the 80 per cent. butter-fat is too low a standard, but in fixing the standards one must be careful not to press unduly on those concerned. Some delegates may also feel inclined to fix the standard as to the amount of water to be allowed in butter, and if that desire exists I might point out that the Adulterated Butter Bill which is now before the British Parliament fixes the standard of water in butter at 16 per cent. It will be seen that all other countries are attending to these matters, and it seems high time that this State did likewise. If the amount of butter-fat fixed at 80 per cent., and the amount of water at 16 per cent. as a maximum, it will be seen there is a margin of 4 per cent. left for salt, casein, &c. From experience I know that none of our factories will find any difficulty in keeping within these limits.

Clause 17 has been referred to higher up as that in which a misprint occurred in copying it from the New Zealand Act. Farmers on the Northern Rivers and elsewhere were frightened that this clause was intended to prevent their trading with the other States of the Commonwealth, but as the clause now stands there can be no mistake on this point. This clause really is the main one controlling the grading of butter. It means that the Governor may, by proclamation in the *Gazette*, name any port in this State as a suitable one from which to export butter, and hence would have the power to appoint a grader to deal with the produce passing through such port. Part (*b*) of this clause has also been altered, and as it now stands it really means that all suitable buildings may be registered for the storing or freezing of dairy produce for export, and this is in accordance with the right to inspect these stores to see that they are not such as will cause undue deterioration in our dairy produce. I do not think the farmers will object to this part, and I cannot see why merchants should have any objection to it either. Those who have will probably possess premises for storing butter that are unfit for the purpose, and hence the sooner they are controlled the better for the dairy industry.

Clause 18 is a very important one, as it to a certain extent controls the conditions under which butter is shipped. Part (*a*) is a health clause,, and needs no explanation. Part (*b*) has really already been discussed, because it refers to the previous clauses and to the regulations made for guaranteeing the shipping under proper conditions of our dairy produce, and part (*c*) refers to the condition of the ship itself. We know that merchants have reported many grievances with reference to the shipping of their butter, such as putting butter which has been reduced to a low temperature, in the same chamber and close to butter which has been only partly cooled, with the result that those who took the trouble and expense to properly cool their butter suffered at the hands of those who were allowed to place their butter aboard the ship at a higher temperature. Often have merchants and producers asked that vessels carrying dairy produce to England should carry in their freezing rooms a self-registering thermometer, which should show the lowest and highest temperature of the room during transit to England. They have also asked that they be allowed to inspect the cold rooms of these vessels. Now this Bill makes provision for these powers, and this clause should have the support of both producers and merchants.

### *Sale, Export and Import, of Margarine.*

The clauses referring to margarine are such as to guarantee that it shall be sold as margarine and not as butter, and this should be all the dairy farmer would require. In older countries and in America there is ample evidence of the great injury which the fraudulent sale of margarine has done to the butter industry; and so important has this question become in the United States, that a very heavy tax has been placed on the manufacture of margarine, made under such conditions, as to make it impossible to mistake it for butter.

As these clauses have met with general approval from our producers, it does not seem necessary to go into any detailed explanation. It is seen that subsection 2 of clause 19 prohibits the manufacture of a margarine mixture containing more than 20 per cent. of butter-fat. This means that manufacture of margarine containing so much butter as to make it difficult for the purchaser to tell whether it is butter or margarine is prohibited. The Conference might think it wise to still further limit the amount of butter which shall be allowed to be added to margarine. Needless to say the less butter added the easier it is to detect the margarine mixture from butter.

### *Regulations.*

No Act can deal with all the details necessary in regulations, and hence it is necessary to obtain power to make regulations dealing with details. For this purpose the regulations in the Bill have been made. Some of these regulations have since been struck out, as you will see, as unnecessary, because sufficient details are already given in the body of the Bill. The regulations here presented to you are so simple that they cannot be misunderstood, and hence delegates may discuss them without any further explanation, save to point out that, with regard to Part (*k*), which provided for the inspection, grading, and marking of dairy produce, it will be necessary for factories complying with such regulation, in order to make the grading of butter simple, to mark each churning separately with a private mark of their own, which shall only be known to the grader and to the factory manager, also to place the date of churning on each package. It will then be only necessary to examine one box out of each churning, and hence the amount of grading required would be considerably reduced. Factories placing wrong marks on the boxes would, of course, be liable to a penalty, so that it is scarcely possible that a factory manager who has very little to gain will endeavour to mislead the grader by marking good and bad butter as of the same churning. The Bill does not provide for any central store in which butter shall be graded, nor does it seem necessary or advisable to do so, as we have already in Sydney sufficient cold storage accommodation to meet present requirements.

Mr. WILLIAMS: Was the Bill intended to control all butter manufactured, or only that intended for export?

The MINISTER FOR AGRICULTURE: The Bill provided only for export, but the question was open for discussion.

Mr. BRANDON: Could the matter of the Bill generally be referred back from delegates to the farmers they represented?

The MINISTER FOR AGRICULTURE: Well, time must be a consideration, but such a matter rested with the Conference. He courted the fullest discussion, but hoped there would be no postponement. He made no threat, but he felt compelled to say that, if the Conference should follow the lead of those who met earlier in the week, and decided that there was no need of the Bill, he would be bound to carry the measure forward. As the Minister for Agriculture, with the best interests of the dairying industry at heart, he must submit the Bill to Parliament.

At this stage the Minister for Agriculture vacated the chair, explaining that there were many very pressing departmental matters requiring his immediate attention, and the chair was taken by Mr. W. S. Campbell, Director of Agriculture.

Mr. GRAHAM: Before the Minister leaves, we should accord him a hearty vote of thanks for the commendable manner in which he has worked for the interest of the dairying industry. He has asked us to meet him and discuss this Bill with him, and has given us every opportunity to thoroughly consider it before it is passed into law. I move a hearty vote of thanks to the Minister.

Mr. WARDEN, in seconding the motion, took exception to the Minister for Agriculture's remarks in reference to the Conference which was held in Sussex-street. As one who was partly responsible for the gathering, he wished to say it was arranged some months ago, when it was not known when the present Conference was to be held. He resented the imputation that the former meeting was unseemly.

The vote of thanks was carried with acclamation.

It was then decided that the Bill, as a whole, should be discussed and then taken clause by clause, each delegate being limited to five minutes' speech on each occasion.

Mr. REYNOLDS (Molong) said that he looked to the Bill to separate the dirty producer from the clean. It would protect those who produced a good article and established a first class reputation from being pirated. It was very necessary for the future of the industry that it should be built up on a foundation of this kind, and he trusted that the measure would be very stringent.

Mr. GRAHAM (Hunter River) said that the measure had not been introduced in the interests of any one man, but because their produce was not capable of taking its part in open competition with the world. The Bill would assist the dairymen to produce an article which could compete in any market.

Mr. GIBSON (Crookwell) said that the industry had not been built up by legislation. Was it right for the State to step in and impose legislation? The Government might as well interfere with the production of bricks. If there was danger of contamination and injury to health, the interference might be justifiable, but it should be reduced to a minimum. That danger, however, was very slight.

Mr. ALCORN (Northern Rivers) considered there was already enough legislation. They had done the pioneering work; they had hewn their homes out of the solid bush; and their butter was the best produced. The public health was protected by the Public Health Act. Was not the dairying industry one of the best assets the State possessed?

Mr. GOODMAN (Hunter River) believed that, although dairymen might be able at present to take liberties, provision should be made for the future. He concurred with the speaker who desired to separate the clean from the dirty. In his experience he had found that sufficient cleanliness was not observed. He had seen a good deal of carelessness in the method of conveyance of cream. If one man was allowed to convey his cream to the factories in a dirty conveyance and dirtily handled, it would not be fair to the man who exercised scrupulous cleanliness in the handling of his cream. He said he certainly believed that butter should be graded. (Voices: "Cream.") He believed that a great deal of the trouble in the matter of our exports was owing to the fact that butter was exported to the Home markets which was never intended to be exported. The butter coming into the hands of the middleman was often dealt with for export which was never made for such. He considered that such a Bill as this would be to the benefit of everyone engaged in the industry, and in the future would be of the greatest benefit to the country. He would like to know if it was intended to provide for the grading of cream.

The CHAIRMAN: In clause 26, section (*k*), there is provision for the grading of cream.

Mr. MCPHILLAMY (Bathurst) said that, while he believed in the general principle of the Bill, he thought the grading should be done in England.

Mr. BRASCHE (Macleay) thought the butter should be graded at the factories. The Government should fix a maximum standard for the very best butter, and other standards for different classes; and factory managers should be advised and instructed in them, and if found guilty of wrongly labelling butter, made liable to punishment. He thought all the opposition to the measure had arisen through its regulations. Dairymen would be entirely subject to the whims of inspectors. If the Minister intended to assist dairymen, he should adopt a standard of the buildings required and supply the fullest particulars.

Mr. BROWN (Kiama) said that he represented owners of 60,000 dairy cattle. He wished to know whether farmers were to be saddled with the maintenance of the present inspectors under the Municipalities Act, and, in addition, have to bear the burden of Government Inspectors under the new Bill. Who, he wished to know, would administer this Act?

The Chairman: The Minister for Agriculture would administer the Act. He might explain that under the new measure the Municipal Inspectors would be dispensed with. Only in the cities of Sydney and Newcastle would the inspection as heretofore be conducted by the Municipal Inspectors.

Mr. Brown said the dairy farmers wanted a competent veterinary surgeon appointed by the Government, and he would like to know who was going to pay for it?

The Chairman explained that the registration fee of 2s. 6d. was intended to pay for the administration of the Act.

Mr. Manning (Bega) said that the chief point of trouble was to know how the Bill was to deal with the export of butter. The Health Act had not educated factory managers as it should have done. Butter sometimes improved by keeping and sometimes it went off. If the butter was graded in the State, what guarantee would they have that it would not deteriorate on the voyage to England? That was the main difficulty. No one for a moment doubted that a Bill was required. Buildings in Sydney that hitherto had not been inspected would now be inspected. He favoured the grading of butter at the factories, and was opposed to its being opened in the State after having been packed. He was opposed to the Bill so far as it regulated the export of butter and the grading in Sydney.

Mr. Loder (Tweed) said that there had already been a Dairy Supervision Act, and that measure had proved satisfactory from a point of cleanliness. Dairymen who made the first-class article should not be harassed, but at the same time the question must be considered from a national point of view.

Mr. Collins (Candelo) said that in his district dairymen had been harassed by the inspectors and the police to an extreme degree. The system of inspection had been a total failure. He would like to know, also, how they intended to regulate the matter of compensation for animals destroyed on condemnation which afterwards proved to be free from disease.

Mr. Alex. Hay (Dairy Farmers' Union) deprecated the idea that the Bill was drafted to injure the industry. It seemed to him, although he could not understand it, that the chief opposition was coming from those who were producing first-class butter. There were no provisions in the Bill that would affect producers of the first-class article. Countries that had adopted some system of grading had neither injured the industry nor the farmers, but, as a matter of fact, dairying had flourished under the change. New Zealand was a striking instance of the success of Government grading. Although he did not approve of the system which had been adopted there, it was remarkable that of the butter exported from New Zealand the first-class grade showed very high. He would quote some of the latest figures in this direction. Of the quantities and grades of creamery butter passing through the cold stores for export to the United Kingdom during the year ending 31st March, 1902, of the total quantity 95·54 per cent. was of the first grade, 4·44 per cent. of the second grade, and 0·02 per cent. was of the third grade. Then of the total quantities and grades of butter passing through the Government cool stores for export to Australia, South Africa, and the South Sea Islands during the year ending 31st March, 1902, 97·16 per cent. was of first class, 2·79 per cent. of the second, and 0·05 per cent. was of third grade. Unless this State could produce for export a better article than we were at present turning out, the export trade must be left out of consideration.

Mr. F. Morton, M.L.A., said that he was not opposed to the grading, but he thought that the Government should make it optional. It was a farmer's own business to decide whether or not he should grade.

Mr. WARDEN (Dairy Farmers' Union) said that anyone who listened to the Minister and others who had advocated the Bill might think that the only salvation for the butter trade lay in grading. It was rather astonishing to hear people talk of the deterioration of butter in New South Wales. They should remember that ten years ago it was almost impossible to get good butter in Sydney, but to-day the first-class article could be procured anywhere. Surely that showed an improvement in the method of production? If a factory manager did not secure the best price, that should be sufficient to make him grade without the Government stepping in. If it was good for the Government to grade, why make it compulsory? Why not leave it optional, and then if it were desirable to grade everybody would adopt that course? He failed to see that grading would improve the industry.

Mr. WILLIAMS (Richmond River) said that the Dairy Supervision Act would not make good butter. They should object to the Agricultural Department taking the industry under its wing. The Government was wrong in thinking that to grade 20 per cent. of the State's butter would place the industry on a proper footing. There was no doubt that some of the factories were at present grading their butter, but he considered it was done in a perfunctory manner. He certainly considered that the proper place to grade the butter was at the factory.

Mr. McINTYRE (Factory Managers' Association) said that while he did not believe in undue Government interference he thought that there was room in the dairying industry for very material departmental assistance. It had been shown over and over again that the first-class article sold readily, while the second class was only passed off with difficulty. He thought that the grading should be done at the factories.

Mr. MATTHEWS (Cootamundra) supported the Bill with probably a few amendments. One matter he was very anxious about was the probability of vexatious annoyance which might be caused by inspectors under the Act. He moved:—

> That the Minister be requested, on all appointments of inspectors, that they be persons qualified by examination to be capable of inspecting the dairies and cattle, so as to avoid dual inspection.

Seconded by Mr. HUTCHINSON, and carried.

Mr. O'CALLAGHAN reminded the delegates that any motions they might submit would necessarily be submitted to the Parliamentary Draftsman, but he had no doubt the Minister would be glad to have the motions as suggestions from the Conference, and although they might not be in strict form, the spirit of the motion would convey the wishes of the Conference.

The CHAIRMAN now requested Mr. O'Callaghan to read through the clauses of the Bill to enable the Conference to discuss them *seriatim.*

> 1. This Act may be cited as "The Dairy Industry Act, 1903."—Passed.
>
> 2. Nothing in this Act shall effect the operation of the Public Health Act, 1896, or the Cattle Slaughtering and Diseased Animals and Meat Act, 1902.

Mr. CAMERON raised the question as to whether this would interfere with the ordinary slaughtering under the Meat Act and the Board of Health regulations on the same subject.

Mr. O'CALLAGHAN explained that this had been considered by the Parliamentary Draftsman, who had been told to avoid any duplication of inspection, and he did not think they would have one Act pulling against another.

The CHAIRMAN thought it might be well to allow the clause to stand over for the present, in order that the Cattle Slaughtering Act might be looked up.

3. The Dairy Supervision Act, 1901, is hereby repealed, except in the cities of Sydney and Newcastle.

Mr. O'CALLAGHAN explained that he had already referred to this clause in his explanation of the Bill. He might remind the Conference that this clause would not do away with the inspection of milk-vendors' shops in the cities mentioned. It was intended that it should apply to the dairies.—Passed.

4. In this Act, unless the context otherwise indicates or requires,—

"Butter-fat" means the pure fat of milk.

"Condensed milk" means milk condensed or concentrated by any method whatsoever.

"Conveyance" includes every description of cart, waggon, truck, or other vehicle.

"Dairy" means—

(*a*) A milk-house, milk-shop, dairy factory, and any other place where dairy produce is collected, deposited, treated, separated, prepared, or manufactured, or is sold or offered or exposed for sale; and includes

(*b*) A farm, stock-yard, milking yard, paddock, shed, stable, stall, and any other place where cows, from which the milk supply of a dairy is obtained, are depastured or kept.

"Dairy factory" means any building or place where dairy produce is prepared, manufactured, or blended for sale; and includes margarine factories.

"Dairy produce" means milk, butter, cream, cheese, condensed milk, or any other product of milk or cream.

"Margarine" includes all substances, whether compound or not, prepared or manufactured from any form of animal fats (other than butter-fat or milk), or of animal, mineral, or vegetable oils, and capable of being used as a substitute for butter.

"Milk" means milk of cows, goats, or sheep.

"Minister" means the Minister for Agriculture.

"Owner" means the owner, whether jointly or severally, and includes the owner's agent or manager; it includes also, in the case of a company, the manager, secretary, or other principal officer thereof.

"Package" includes cask, keg, crate, can, box, case, wrapper, tin, and every other receptacle or covering used for the packing of dairy produce.

"Prescribed" means prescribed by this Act, or the regulations made thereunder.

"Pure milk" means the whole of the milk, including the strippings, drawn at the time of milking; but does not include the milk which contains less than 3 per centum of butter-fat, or less than 8·5 per centum of solids other than butter-fat, or is mixed with any preservative or chemical, or colouring matter of any kind whatsoever.

"Regulations" means the regulations made under this Act.

"Separated milk" means pure milk from which the butter-fat has been abstracted.

"Vessel" includes every description of ship and boat.—Passed.

### *Appointment of Officers.*

5. The Governor may appoint such inspectors and other officers as he deems necessary for the administration of this Act, and may by regulation prescribe their powers and functions.

Mr. MATTHEWS explained that his motion previously moved and carried was intended to be read in conjunction with this clause.—Passed.

### *Registration.*

6. (1) Every person carrying on business at a dairy shall apply in the manner prescribed that the same be registered ; and on such application being so made, and on payment of a fee of 2s. 6d. (two shillings and sixpence), such dairy shall forthwith be registered, and a certificate of registration shall be sent to the applicant as prescribed.

In the case of a dairy at which business is being carried on at the commencement of this Act, such dairy shall be registered within three months after such commencement.

In the case of a dairy at which business is to be carried on after the commencement of this Act, such dairy shall be registered before such business is commenced to be carried on.

(2) Such registration shall be in force until the thirty-first day of December of the year in which the dairy is registered, and on application in the manner prescribed by the person carrying on business at such dairy, and on payment of a fee of two shillings and sixpence, such registration shall be renewed and a certificate of renewal shall be sent to the applicant as prescribed. On such renewal, the registration shall be in force until the thirty-first day of December next ensuing.

Mr. O'CALLAGHAN explained that instead of yearly registration, continual registration is suggested, but an annual certificate which may be obtained by post on paying two shillings and sixpence will be required.

(3) A certificate of registration, or of the renewal of registration, shall be evidence of such registration or renewal.

(4) Any person who, after the time above limited for registration as aforesaid, carries on business at a dairy shall, unless such dairy is registered and the registration thereof is in force, be liable to a penalty not exceeding, where such dairy is a margarine factory, one hundred pounds, and in other cases ten pounds.

Mr. MATTHEWS moved :—"That it be a recommendation that the penalty in cases other than margarine factories be £5."—Carried.

### *Inspection and Sanitation.*

7. In the exercise of his functions under this Act an Inspector may—

(1) At all reasonable times enter, inspect, and examine any dairy, and also any building, conveyance, or ship used for the storage or carriage of dairy produce, and inspect and examine any stock, utensil, machinery, apparatus, or works in a dairy, or used in connection with a dairy or with dairy produce ;

(2) At any dairy, or elsewhere, inspect and examine any dairy produce, or the food or water supply to any dairy, or to the stock in or about any dairy, and also demand, and without payment, take samples thereof for inspection and analysis ;

(3) At any time, and in any place, detain and open any package which contains, or is supposed to contain, dairy produce, for the purpose of inspecting or taking samples of the dairy produce, or of ascertaining whether such package bears or contains any false description or brand.—Passed.

8. (1) In any case where, as the result of his inspection and examination, the inspector is of opinion—

(*a*) That any dairy is in an unclean or unwholesome condition ; or

(*b*) That any utensil, machinery, or apparatus in or about a dairy, or used in connection with dairy produce, is in an unclean or unwholesome condition, or is otherwise unfit for the purpose ; or

(*c*) That any building, conveyance, or ship used for the storage or carriage of dairy produce is in an unclean or unwholesome condition, or is otherwise unfit for the purpose ; or

(*d*) That any cattle in or about a dairy, or used in connection therewith, or with dairy produce, are affected with a contagious disease ; or

(*e*) That any person employed in or about a dairy is affected with any contagious or infectious disease, or is a member of a household wherein any person is affected with any such disease ; or

(*f*) That any food or water supplied to stock, or any water used in connection with a dairy, is impure or unwholesome, he may, by order in writing under his hand, delivered to the owner, consignee, or person in charge, without further name or description, require such matters to be remedied to his satisfaction.—Passed.

(2) The inspector may, by any such order,—

(1.) Direct any dairy, utensil, machinery, apparatus, or work, building, conveyance, or ship, as the case may be, to be forthwith cleansed, disinfected, and rendered wholesome to his satisfaction ; or

(2.) Forbid the same to be used in any way for the purposes of dairy produce, either absolutely or until all defects have been remedied to his satisfaction, or for such time as he thinks necessary ; or

(3) Order any diseased stock to be forthwith removed, and kept isolated from the dairy herd, and if condemned by a veterinary inspector appointed under this Act, to be forthwith slaughtered, and dealt with as prescribed by the regulations ; or

*Explanatory Note.*—Appeal from order for slaughtering of stock alleged to be diseased to be made to a Police Magistrate. Where an animal is slaughtered in error as being diseased, compensation at ordinary market valuation will be allowed.

(4) Forbid the removal from a dairy of any dairy produce suspected of adulteration or contamination for such time as he thinks necessary.

Moved by Mr. BRANDON, seconded by Mr. WILFORD : "That it be a recommendation that a month's notice at least be given before such shall take effect, except in cases of contagious diseases."—Carried.

Moved by Mr. HUTCHINSON, seconded by Mr. BROWN : "That the owner of any beast or beasts condemned by the inspector shall have the right to claim that such beast or beasts be isolated for a period to be determined by the inspector, and if subsequently found by the said inspector to show signs of disease, the owner shall have the right to appoint a person to represent him in arriving at a valuation of the said beast or beasts, and the said owner shall be paid the amount of valuation arrived at. Should the beast or beasts on being destroyed be found not to be diseased, should they disagree as to the amount they shall mutually appoint a referee, whose valuation shall be final, and that in case of dispute as to disease, the part or parts said to be diseased shall be sealed up in a vessel by the parties interested, and handed to the Government Medical Officer to be forwarded to the Government Analyst, whose decision shall be final.—Carried. Clause passed.

9. (1) The inspector shall, by order under his hand, delivered to the owner, consignee, or person in charge, condemn any dairy produce whenever he is satisfied (proposed addition—"After consultation with the Analyst under this Act") that such produce is unfit for human consumption.

(2) All dairy produce so condemned shall be disposed of in such manner as is prescribed, and shall not be sold or offered or exposed for sale or exported.—Clause passed.

10. In every case where disease appears in any stock in or about a dairy, or where any person living or working in or about a dairy is found to be affected with any contagious or infectious disease, the owner or person in charge shall—

(1) forthwith draft out and at all times keep separate all such diseased stock from the stock not suffering from disease;

(2) at all times prevent the milk or cream obtained from such diseased stock being mixed with other dairy produce or being in any way sold or used for food;

(3) as far as practicable, isolate and keep isolated every person so affected with any contagious or infectious disease;

(4) forthwith give notice thereof in the manner prescribed to the inspector, and also

*Note.*—Suggested by Conference that "and also" be eliminated and "or" inserted.

to the officer in charge at the nearest Police Station, or to the Secretary of the Board of Health.

*Note.*—Suggestion by Conference:—It being understood that Board of Health means the Local Government Medical Officer.

11. Whenever requested, the owner or person in charge of a dairy shall furnish to the inspector and

*Note.*—Suggested by Conference that "and" be eliminated and "or" inserted.

to the Board of Health,

*Note.*—Suggestion by Conference:—It being understood that Board of Health means the Local Government Medical Officer.

(*a*) a list of the customers or other persons supplying milk or cream to such dairy; and also

(*b*) any personal assistance and information in his power in order to enable the inspector or the said Board to search for and discover any source of contamination, infection, or disease to which any stock or dairy produce may be exposed.

12. The owner or person in charge of a dairy shall from time to time supply to the Minister such statistics relating to such dairy as are prescribed.—Passed.

13. (1) No person shall begin to keep pigs within fifty yards, or place or begin to use any fowl-house, manure-heap, cesspit, or closet within thirty feet of any dairy as defined in paragraph (*a*) of the definition of "dairy" in section 4 hereof.

(2) No person shall erect or begin to use any place as a dairy as last aforesaid within fifty yards of any piggery, or within thirty feet of any fowl-house, manure-heap, cesspit or closet.

(3) No person owning or having charge of any stock or pigs shall permit any drainage therefrom to flow into or (unless in a properly enclosed drain) within fifty yards of any such dairy as last aforesaid, or of any open water supply thereof.—Passed.

*Sale and Export of Dairy Produce.*

14. (1) No dairy produce intended for sale or supply for profit shall be deposited or stored or kept by any person in any room used for domestic purposes, or in any place calculated to render such produce unwholesome or injurious to health.

(2) No person shall sell or expose or offer for sale any dairy produce which shall be kept in contravention of the preceding subsection.—Passed.

15. (1) No person shall—

(1) mix with or add to, or use in the manufacture of any dairy produce any extraneous ingredient of any description;

*Note.*—Suggestion by Conference:—"That cream be allowed to have preservative added if used for butter-making and not for selling."

(2) Provided that, subject to the regulations, nothing herein shall prevent pure sugar, common salt, or boric acid to the extent of half per centum in butter, or any harmless coagulative or colouring ingredient from being used in the manufacture of dairy produce other than margarine.

(2) No person shall sell or offer, or expose for sale any dairy produce manufactured in contravention of the preceding subsection.—Passed.

(16) No person shall sell or supply to a dairy for any purpose whatsoever, or to any person for human consumption—

(*a*) any milk or cream which is unfit for human consumption;

(*b*) any milk or cream from any milk which has been drawn from a cow that is known or suspected to be diseased, or that has calved within four clear days before the day on which the milk was drawn from her; or

(*c*) any milk sold for consumption as milk which is not pure milk,

*Note.*—Suggestion by Conference:—"That we accept the Minister's suggestion that appeal to the cow be allowed in interpretation of this clause."

unless the same is and is sold or supplied as separated milk, and such person at the time of such sale or supply states, and if required states in writing, to the person to whom such milk is sold or supplied that such milk is separated milk; or

(*d*) any condensed milk which contains less than nine per centum of butter-fat and twenty-four per centum of solids other than butter-fat, unless the same is sold or supplied as condensed separated milk, and every package containing the same, whether sold or supplied wholesale or retail, is marked "Condensed separated milk" in capital letters not less than one inch square; or

(*e*) any butter which contains less than eighty per centum of butter-fat.—Passed.

17. The Governor may, by proclamation in the *Gazette*,—

(*a*) appoint any specified port to be a port at which dairy produce, or any specified class or description thereof, may be exported outside the Australian Commonwealth;

(*b*) appoint any specified buildings to be stores where dairy produce may be stored, cooled, or frozen for export.—Passed.

18. No person shall ship or place on board any vessel for exportation from New South Wales any dairy produce, unless—

(*a*) such dairy produce is in all respects sound, in good condition, and free from disease; and

(*b*) the provisions of this Act, and of the regulations relating to such dairy produce, have been duly complied with; and

(*c*) the vessel is equipped in all respects in accordance with the provisions of this Act and of the regulations;

Provided that nothing herein shall apply to dairy produce shipped on any vessel for the sole use of the passengers and crew of the said vessel on the intended voyage.—Passed.

### *Sale, Export, and Import of Margarine.*

19. No person shall—

(1) mix, colour, stain, or powder margarine with any ingredient or material so as to imitate butter; or

(2) manufacture margarine so as to contain more than twenty per centum of butter-fat;

(3) sell, or offer for sale as butter, any margarine or other substance which contains, or with which is mixed, any margarine or extraneous matter, fat, or oil; or

(4) export or attempt to export margarine, unless the same is distinctly invoiced and marked in the manner hereinafter provided as margarine; or

(5) import or attempt to import margarine, unless the same is distinctly invoiced and marked in the manner hereinafter provided as margarine; or

(6) import or attempt to import margarine, mixed, coloured, stained, or powdered with any ingredient or material so as to imitate butter, or containing more than twenty per centum of butter-fat.—Passed.

20. Every manufacturer, importer, or exporter of margarine shall cause every package containing margarine to be distinctly and durably marked "Margarine" on the top and on one side, in printed capital letters not less than one and a half inches square, before the same leaves his premises, and such marking shall be in such a form that it cannot be detached from such package.—Passed.

21. (1) Any person who contravenes any of the provisions of the last two preceding sections shall be liable to a penalty not exceeding fifty pounds, and if he is the owner or person in charge of a dairy factory, the registration of such factory may also be cancelled.

(2) If any person exports or imports, or attempts to export or import, any margarine in breach of any of the provisions of the said two preceding sections, then, in addition to the penalty hereinbefore prescribed, the margarine may be seized by any inspector, and shall be forfeited to the Crown, and sold or otherwise disposed of as the Minister directs or the regulations prescribe.—Passed.

22. (1) Any person who sells margarine by either wholesale or retail, save in a package marked as aforesaid, shall deliver such margarine to the purchaser in or with the wrapper on which is distinctly printed "Margarine" in capital letters not less than an inch square.

(2) Every person who contravenes any of the provisions of this section shall be liable to a penalty not exceeding twenty pounds.—Passed.

### *Offences and Penalties.*

23. Any person who, directly or indirectly, by himself, his agent, or servant—

(1) resists or wilfully obstructs any inspector or other officer under this Act in the performance of his duty; or

(2) refuses to give information, or gives false information, in answer to any inquiry made by any such officer in the performance of his duty; or

(3) knowingly makes any statement required by this Act which is false in any material particular; or

(4) commits any breach of any of the provisions of this Act for which no penalty is provided by this Act elsewhere than in this section: shall be liable to a penalty not exceeding fifty pounds.

*Note.*—A motion to reduce the amount of the penalty from £50 to £25 was negatived on the voices.

Provided that—

(*a*) In any case where any offence under this Act is also any offence under any other Act, proceedings may be taken under either Act; but no person shall be punished twice for the same offence;

(*b*) In any case where any duty or obligation imposed on any person by this Act is also imposed on him by any other Act, compliance with either Act shall be deemed to be compliance with both.—Passed.

### *Regulations.*

24. The Governor may make regulations generally for carrying out the provisions of this Act, and in particular—

(*a*) prescribing the mode of registration and renewal of dairies under this Act;

(*b*) for the registration of marks, stamp, brands, used for dairy produce;

*Note.*—Question by Conference as to the operation of the Trade Marks Act in relation to this clause, and particularly in relation to present existing registered brands.

(*c*) prescribing the materials of which the floors of dairies shall be constructed, and the mode of the construction thereof;

*Note.*—Motion carried unanimously by the Conference:—"That the materials for the floors of dairies shall consist of wood, cement, or any materials that shall be considered satisfactory to the inspector, and laid down in a manner to satisfy said inspector."

(*f*) prescribing and regulating the lime-washing, painting, cleansing, and disinfection of dairies;

(*g*) for preventing the pollution of water used in dairies;

*Note.*—Motion carried by Conference:—"That one room for separating, storing of cream and cans, shall be deemed sufficient, and that such building need not be dust-proof."

(*j*) for preventing or regulating the use of preservatives or the adding of other matters in the manufacture of dairy produce;

*Note.*—Motion carried by Conference:—"That a small percentage of preservitas be allowed for use in cream, such quantity, even with what is used in butter to not exceed the quantity stipulated in the Bill."

(*k*) for the inspection, grading, packing, marking, stamping, branding, and labelling of dairy produce;

*Note.*—Motion:—"That in the opinion of the Conference the grading of butter is necessary." Amendment:—"That sub-clause '*k*' be omitted from the Bill." The Amendment on being put was negatived by 15 votes to 4. The Motion was carried by 16 votes to 2. Motion:—"That there be two grades of butter, first and second."—Carried unanimously.

(*m*) prescribing the conditions under which dairy produce may be stored, cooled, or frozen for export;

Motion:—"That monthly returns be made of all butter placed in cold stores in New South Wales."—Carried unanimously.

(*n*) prescribing the form of any notice or other document under this Act or the regulations;

(*o*) prescribing the matters in respect of which fees shall be payable, and fixing the amount of such fees, and may in such regulations impose any penalty not exceeding fifty pounds for any breach of the same.

All such regulations shall be published in the *Gazette* and shall thereupon have the force of law, and shall be laid before both Houses of Parliament within fourteen days after such publication if Parliament is sitting, or if Parliament is not sitting, within fourteen days after the commencement of the next session of Parliament.

*Note.*—Motion carried unanimously by the Conference:—"That it is desirable that some penalty should be fixed for an offence of altering, erasing, or defacing a brand or date on any box of butter, and it be suggested that the penalty should not be less than £100 for the first offence, and £500 for any subsequent offence."

25. All fees received and penalties recovered under this Act or the regulations shall be paid into the Consolidated Revenue Fund.—Passed.

On the motion of Mr. Brown, a hearty vote of thanks was carried to the Chairman (Mr. W. S. Campbell) for presiding.

The Chairman, in returning thanks for the vote of thanks, tendered to the delegates the thanks of the Minister for Agriculture for the very intelligent manner in which they had considered the Bill. He had no doubt the Minister would be very pleased at the result of the Conference. He thought they had thrashed out the Bill very well, and he thought they had carried it through just as the Minister desired. For his own part he considered that the filling of the chair at the Conference had been the easiest duty of the kind he had ever experienced.

This concluded the Conference.

# The Pastoral and Agricultural Societies' Union of N.S.W. Annual Conference.

The Annual Conference of delegates from affiliated societies under the Pastoral and Agricultural Societies' Union of New South Wales was held at Tattersall's Chambers, Sydney, on Wednesday, 15th, Thursday, 16th, and Friday, 17th April, Mr. C. H. Dight, M.L.A., the President of the Union, occupying the chair. The following delegates were present:—

W. Drew, Armidale.
T. H. Griffith, M.L.A., Albury.
Geo. Death, Blayney.
L. Cohoun, Broken Hill.
H. T. Edwards, Bombala.
J. J. Miller, Balranald.
E. J. Gorman, Berrigan.
Ezra Harvey, Crookwell.
S. H. Dickson, Cootamundra.
R. H. Lalor, Castle Hill.
P. Oakden, Cobar.
J. C. Ryrie, Cooma.
W. L. Ross, Cumnock.
Fred. Moore, Campbelltown.
W. G. Simpson, Casino.
C. H. Brooks, Candelo.
E. L. Archer, Corowa.
F. W. Downes, Camden.
Hon. W. Bennett, M.L.A., Dungog.
W. R. Clarke, Deniliquin.
N. A. Gatenby, Forbes.
E. M. Bowman, Gulgong.
J. F. Chaffey, Glen Innes.
W. Glasscock, Gundagai.
G. T. C. Wilson, Germanton.
George Cousins, Grenfell.
A. C. Ronald, Hay.
John Borthwick, Inverell.
H. O'B. Wilson, Lismore.
V. D. Cox, Mudgee.
R. T. Keys, Muswellbrook.
Geo. W. Griffith, Manildra.
J. B. Newman, Murwillumbah.
W. H. Goodman, Newcastle.
A. G. Carruthers, Nyngan.
J. F. Willans, Narrandera.
W. Tanner, Orange.
G. W. Seaborne, Parkes.
R. Davidson, M.L.A., Port Macquarie.
Geo. Haughton, Quirindi.
Rev. J. Howell-Price, Richmond.
C. H. Dight, M.L.A., Singleton.
A. M. White, Tenterfield.
A. Matheson, Tamworth.
Sydney Hargrave, Walcha.
R. F. Graham, West Maitland.
W. Somerset Andrews, Wingham.
H. te Kloot, Warren.
G. H. Gordon, Warialda.
W. Vanstone, Walgett.

The Annual Report of the Council was read as follows:—

The Council of the Pastoral and Agricultural Societies' Union of New South Wales herewith present their third annual report.

*Meetings.*—The Council held five meetings during the year, at which the attendance was as follows:—C. H. Dight, M.L.A., president, 4; F. W. A. Downes, vice-president, 4; T. C. Worboys, treasurer, 4; R. T. Keys, vice-president, 3; P. Oakden, vice-president, 3; R. Davidson, M.L.A., vice-president, 3; H. E. McIntosh, vice-president, 2.

*Societies.*—During the year nine additional societies have affiliated with the Union, namely: Alstonville, Glen Innes, Burrowa, Albury, Lismore, Berrigan, Broken Hill, Richmond, and Corowa. The total effective strength of the affiliated societies now stands at 64.

*Judges.*—The work of compiling a register of single judges, authorised at the last conference, has been carried out, nominations having been made by the affiliated societies and acceptances signed by those nominated. The register has been circulated among the societies, and there is reason to believe the work has proved of much service to the societies in making the appointments of judges. The system of single judging and giving reasons for decisions has been widely adopted by the societies, thus rendering the work of the societies more effective and educational. The council being unable to induce the Minister for Agriculture to provide free transit on the railways for societies' judges travelling in the execution of their duties, prepared a petition to Parliament, which, after having been signed by upwards of seventy societies, was presented by the president of the Union, Mr. C. H. Dight, M.L.A., who also interviewed the Colonial Treasurer and secured his promise to bring the matter before the Cabinet. The country party in Parliament unanimously decided to support the proposal, but we regret to have to report that all our requests and representations on the matter have been of no avail.

*Loans on Societies' Grounds.*—Pursuant to instructions from the last conference, we have had interviews with the Minister for Agriculture with the view of securing power for societies to raise funds upon the security of their grounds. Whilst the Minister for Agriculture favours the proposal, we regret to state that the Minister for Lands, whose department exercises authority over the dedication and titles of show grounds, has raised objections to such power being vested in committees or trustees, consequently our efforts on behalf of the societies in this matter have failed.

*Subsidy for School Children's Prizes.*—Being unable to induce the Department of Agriculture to remove the embargo against school children's exhibits participating in subsidy, we applied to the Minister for Public Instruction to help the societies in this matter. His reply was that no funds were available for such a purpose.

*Clashing of Show Dates.*—Though the Union has endeavoured as far as possible to prevent shows in close proximity to each other from clashing in their show fixtures, several instances of clashing have occurred during the year. Some of the societies neglect to acquaint the Union of the dates of their fixtures. It is a question for the conference to consider whether it would not be wise for a roster to be fixed at the annual conference, as a recommendation and guide to the societies.

*Disqualifications.*—We are pleased to report that only five disqualifications of exhibitors have been recorded during the year. These have been duly registered and reported to the affiliated societies, and have been generally endorsed by them. The adoption of this system has been welcomed by the societies, and is considered to be productive of good results.

*Pastoral and Agricultural Bills.*—The Minister for Agriculture promised to keep the Union supplied with copies of any bills that may be introduced to Parliament dealing with agricultural matters, in which the Union may be able to assist by suggestions, but during the year no copies have been received by the Council for consideration in this matter.

*Chamber of Agriculture.*—Pursuant to resolution of the conference, the Council took steps to establish a Chamber of Agriculture for New South Wales. A constitution was drawn up and adopted, copies of which have been furnished to all the societies. Provision is made for the affiliation of societies with the Chamber. The Council sought the opinion of the societies upon the question of affiliation, but owing to failure to understand the relative positions of the Chamber and the Union, the referendum was not largely availed of, only sixteen societies having voted out of sixty-two, thirteen of which were favourable to affiliation with the Chamber. The question of merging the Union into the Chamber, and so establishing a strong representative institution, will be a matter for the delegates assembled in conference to decide. There is every reason to hope that the Chamber will receive practical support when inaugurated. Already some fifty members have enrolled themselves and paid their subscriptions; these members are representative of the whole of the State, from Inverell to Wilcannia, from the coastal districts to the Victorian border. The Council has arranged for a public meeting in connection therewith for Thursday, the 16th April, when it is confidently expected considerable life will be galvanised into the movement. This undertaking has entailed considerable work upon the Council during the year, and has engrossed as much of the time and attention of the secretary as all the rest of the work of the Union put together. We trust, therefore, that our labours will meet with the approval of the delegates and the societies.

*Distressed times.*—The Council, realising the terrible and baneful effects of the protracted drought, and fully sympathising with all those who have been compelled to fight against it, early in the season approached the Federal Government by memorial in conjunction with the Stock Boards' Council of Advice with a view of securing the remission of duties on fodder for starving stock. As is too well known, our appeal, as well as that of other representative bodies, has not been successful. The Council fully recognised the great help extended to stockowners by the Railway Commissioners in carrying fodder for starving stock at a nominal charge; and on behalf of the societies we addressed a letter of commendation and thanks to the Commissioners for their prompt action in this respect, which has been courteously acknowledged and appreciated.

*Reciprocal relations.*—The Council reports having maintained reciprocal correspondence with the following kindred institutions:—Department of Agriculture, Washington; Royal Colonial Institute, London; Chamber of Agriculture, London; Chamber of Agriculture, Queensland; Chamber of Agriculture, California; Chamber of Agriculture, Victoria; South Coast Union, Wollongong; and the Northern Union, Glen Innes. Whilst considerable correspondence has passed between the affiliated societies and the Union secretaries may with advantage make a point to keep the Union posted in matters in connection with their societies, such as fixing of show dates, election of officers, disqualifications, annual reports, &c.

*Conclusion.*—In conclusion, the Council regrets that the requests of such a representative institution as the Union relative to the carrying of judges free on the railways should be disregarded by those in authority. The requests that have been made are reasonable, and in the interests of the great producing industries, upon which so much of the well-being and prosperity of the country depends. It will be for the conference to consider whether any further action shall be taken by which the wishes of the societies may be secured.

Signed on behalf of the Council,

**C. H. DIGHT, President.**

BALANCE SHEET of the Pastoral and Agricultural Societies' Union of New South Wales for the year ending 31st March, 1903.

| *Receipts.* | £ | s. | d. |
|---|---|---|---|
| To Balance from 1902... .. | 107 | 13 | 11 |
| 56 societies' subscriptions | 117 | 12 | 0 |
| 43 members' subscriptions, Chamber of Agriculture | 21 | 10 | 0 |
| Exchanges received ... | 0 | 6 | 0 |
| | £247 | 1 | 11 |

| *Expenditure.* | £ | s. | |
|---|---|---|---|
| By Printing, stationery, &c. ... | 32 | 12 | 2 |
| Postages, telegrams, &c. ... | 21 | 8 | 10 |
| Sundry petty accounts .. | 2 | 10 | 0 |
| Advertising ... ... ... | 2 | 3 | 6 |
| Rent of hall... ... ... | 2 | 15 | 0 |
| Bank fee, exchanges, &c. ... | 2 | 8 | 6 |
| Secretary's salary ... ... | 52 | 0 | 0 |
| Cash in hand ... ... | 0 | 0 | 6 |
| Balance at City Bank ... | 131 | 3 | 5 |
| | £247 | 1 | 11 |

THOS. C. WORBOYS, Treasurer.
J. J. MILLER, Secretary.

WE have examined the above accounts, and compared them with the vouchers and bankers' pass-book, and we find them correct.

ERNEST CARTER, }
WILLIAM MUGGRIDGE, } Auditors.

The PRESIDENT moved the adoption of the report and balance sheet, and welcomed the delegates to the Conference.

MR. OAKDEN (Cobar), Vice-President, seconded the motion, which was supported by the Hon. W. Bennett (Dungog), and carried.

The DIRECTOR OF AGRICULTURE (Mr. Campbell) was formally welcomed by the President, and he acknowledged the compliment, and shortly addressed the delegates.

The PRESIDENT stated that the Premier, Sir John See, had promised to attend and open the Conference, but he was unavoidably detained with an important Conference with the Premiers of other States.

## MOTIONS.

### *Chamber of Agriculture.*

MR. P. OAKDEN (Cobar) moved, and Mr. R. DAVIDSON, M.L.A. (Port Macquarie), seconded—

> That in order to build up an enduring institution, representative of all the various agricultural industries, and in order to place the Chamber of Agriculture upon a sound basis, and seeing that every provision is made in the constitution of the Chamber for carrying out the work of the Union, it be now resolved that the Union merge itself into the Chamber of Agriculture, and so concentrate all the forces engaged in primary production.

After some discussion, in which it was evident that the delegates would prefer that the various committees should decide the question, Mr. Oakden withdrew the motion in favour of an amendment moved by Mr. Worboys, "That the motion be submitted by referendum to the Committees of the affiliated societies, the votes to be in the hands of the Secretary by 1st August," which was carried.

The Conference adjourned until 7·30, 16th instant.

## THURSDAY, 16TH APRIL.

The President took the chair at 7·30.

### *Rating of Show Grounds.*

Mr. P. OAKDEN, for Mr. R. T. Keys (Muswellbrook), moved, and Mr. W. DREW (Armidale) seconded—

> That, in order to settle the vexed question of the liability of show grounds for rating purposes by municipalities, the Secretary be instructed to appeal to the Attorney-General, through the Minister for Agriculture, for definite opinion upon the question.

The motion was agreed to.

### *Disqualifications.*

Mr. W. GLASSCOCK (Gundagai) moved, and Mr. W. H. GOODMAN (Newcastle) seconded—

> That, in the opinion of this Conference, the penalising of an exhibitor by disqualifying him for life is too severe and stringent. That all offenders against the rules and regulations of a society should have written notice to attend a meeting of the Committee to show cause why he or she should not be disqualified.

The motion was carried.

### *Show Dates.*

Mr. R. H. LALOR (Castle Hill) moved, and Mr. W. G. SIMPSON (Casino) seconded—

> That, in order to prevent the clashing of show dates in contiguous districts, sub-committees, comprising the delegates from the various districts, be appointed at the Conference to compile a roster of show dates, and, when approved, copies be sent to each affiliated society for future guidance.

The mover said that the advantage of such a roster would be apparent to everyone. Country shows suffered from a want of competition in some sections, but if no show was allowed to clash with another within a distance of 100 miles exhibitors at one show would also be able to compete at other shows in the district. This would be a benefit to all concerned.

Mr. R. F. GRAHAM (West Maitland) said that he feared the resolution, though in every way desirable, would not be productive of any effect. Agricultural societies showed little disposition to meet one another with regard to dates, and it was improbable that they would do so unless they were compelled. He thought that the Minister for Agriculture ought to compel the societies to fix dates that would not clash. These societies were subsidised by the Government, and should not be allowed to trifle with the public funds in the way they had done.

The Hon. JOHN KIDD, Minister for Agriculture, said that to withhold the subsidy would be an extreme step. However, if the State were divided into about six districts, he thought it would be possible to arrange dates that would not clash. He could not understand why all the agricultural societies in the State were not affiliated through the Union. They had a membership of sixty-four societies out of 120. If all were affiliated, it would be easier to arrange dates that would not clash. While he was opposed to withholding the Government subsidy from societies who would not fall into line with the others, he would be disposed to hold out some special inducement to those that did.

The motion was carried.

The Conference then adjourned to permit delegates to attend the public meeting in connection with the inauguration of the Chamber of Agriculture.

FRIDAY, 17TH APRIL, 1903.

The President took the chair at 7·30, and reported that a serious accident had befallen Mr. Vice-President Davidson, who had the misfortune to sustain a fracture of the leg by a tram accident; and, on the motion of the President, a unanimous vote of sympathy was carried, to be conveyed to Mr. Davidson.

### *Hawkesbury College.*

Mr. Vice-President OAKDEN reported that between fifty and sixty delegates with their wives had that day visited the Hawkesbury College, the visit having been enjoyable and instructive. He moved that the Minister for Agriculture be cordially thanked for making arrangements for the conveyance of the delegates, and that a letter of thanks be sent to Mr. Potts, the Principal, for his hospitable attention to the delegates.

The motion was carried by acclamation.

### *Organising Representative.*

Mr. R. H. LALOR (Castle Hill) moved, and Mr. W. GLASSCOCK (Gundagai) seconded—

> That, in view of the objects of the Union and the Chamber of Agriculture being to consolidate effort in developing the pastoral and agricultural industries, the Government be asked to provide a free pass upon the railways for an organising representative of the institutions.

The motion was agreed to.

### *Free Passes for Judges.*

Mr. J. F. WILLANS (Narrandera) moved—

> That further application be made to the Government for free passes on the railways for judges attending shows, the request to apply to one judge only in each section of a show.

The motion was seconded by Mr. R. H. LALOR (Castle Hill), and carried.

Mr. J. F. WILLANS (Narrandera) moved, and Mr. J. B. NEWMAN (Murwillumbah), seconded—

> That, in future, the Union forward a balance-sheet and report to each society, together with the business paper for the ensuing Conference, at least one month before the sitting, so as to enable the different societies to instruct their delegates which motions to support out of those on the list.

The SECRETARY explained that the motion clashed somewhat with the rules of the Union, which could only be altered by special resolution.

The motion was negatived.

### *The Tick Pest.*

Mr. J. B. NEWMAN (Murwillumbah) moved, and Mr. A. M. WHITE (Tenterfield) seconded—

> That, in view of the fact that the Queensland Cattle Ticks have appeared at the New South Wales border (Tweed River District), the Government be urged to take immediate action to prevent the entry of the pest into New South Wales, and, in the event of the entry of the tick, immediate steps be taken to confine the infested area within as close limits as possible, and with such object in view, the following requisitions be made to the Government:—

(*a*) That the Government be urged to complete the wire-netting on the original border fence to connect the two portions already done, and that strict supervision be maintained to prevent all live animals from crossing.

(*b*) That local boards be appointed at any place threatened with tick invasion, such board to have power to quarantine areas, raise moneys, deal with stray stock on roads or Crown Lands, and take all such measures as may be deemed advisable from time to time to cope with the pest.

Mr. A. G. Carruthers (Nyngan) moved, as an amendment, that the following words be added after the word "crossing," end of sub-section (*a*),—"and that the expenditure so incurred be a charge on the State revenues, together with the previous expenditure in preventing the entry of ticks into this State."

The amendment was carried, and the motion, as amended, was agreed to.

### *Director of Agriculture.*

Mr. T. C. Worboys (Parramatta) moved, and Mr. Oakden (Cobar), seconded—

> That this Conference views with approval the practical separation of the Agricultural Department from the Department of Mines, by the creation of the office of Director of Agriculture, believing that thereby greater attention will be secured to the requirements of the agricultural industry.

Agreed to.

### *Judging by Points.*

Mr. G. W. Seaborne (Parkes), moved—

> That it is desirable that a system of judging by points be adopted where practicable, and that a committee of experts should be appointed to draw up a code of rules for guidance in the matter.

Mr. Lalor (Castle Hill) seconded the motion, and it was carried.

### *Election of Officers.*

The following officers were elected for the ensuing year:—

*President:* Mr. C. H. Dight, M.L.A. (Singleton).
*Vice-Presidents:* Mr. R. Davidson, M.L.A. (Port Macquarie).
" " Mr. P. Oakden (Cobar).
" " Mr. R. T. Keys (Muswellbrook).
" " Mr. F. W. A. Downes (Camden).
" " Mr. R. H. Lalor (Castle Hill).
*Treasurer:* Mr. T. C. Worboys (Parramatta).
*Secretary:* Mr. J. J. Miller (Balranald).
*Sydney Auditors:* Messrs. Ernest Carter and W. Muggridge.

### *Papers.*

Papers which are appended hereto were read as follows:—

"Judging at Agricultural Shows," by Mrs. Sophie Corrie.
*"The Improvement of Plants by Selection," by Mr. Herbert J. Rumsey.
*"The Bee Industry," by Mr. E. Tipper.
"Open Judging," by Mr. W. Muggridge.

Votes of thanks were accorded the officers of the Union, and the President declared the Conference closed.

---

* These papers have been held over until next issue.

[*Papers read at Conference.*]

# JUDGING AT AGRICULTURAL SHOWS.

BY MRS. SOPHIE CORRIE.

"What can we reason but from what we know."

Judging at Shows.—This is undoubtedly a much vexed and debatable question. There are those who desire to follow the old system of three judges, whilst there are those who favour the single judge system. The latter is now almost universally adopted.

Having been connected with agricultural shows both as exhibitor and judge for the past seventeen years, it can be easily understood that I must of necessity have some knowledge of the working of these institutions.

There cannot be the shadow of a doubt but the success of a show depends in a great measure on correct judgment. The old system of three judges is to be deprecated, for it consists of nothing more or less than the different opinions of different judges. Judging as carried on by a set of judges consisting of three, the majority decide, but it is not correct judging, for in all probability, the dissenting judge has a better knowledge of the exhibit than his colleagues. In order to have the judging correct, they should all agree, and the decision should be unanimous.

The success of a show depends principally upon three things; a great display of exhibits; exhibits of a superior character; and good judging.

It is pleasing to note that the single judge system has become popular. Having worked under both systems—the three judges, and the single judge—it is easy to decide and determine which is the most satisfactory both to the exhibitor and to the one adjudicating. Admitting there are those who are prejudiced against the single judge system, that is invariably the rule with most new departures. Personally I have always advocated the single judge system, and still hold that opinion, in fact when invited to judge at agricultural shows, I object to accept office unless the appointment be as single judge.

A system should be established in order that the services of competent judges can be procured. A judge has an honorable and important position, and should realise that, and fulfil in every sense the duties and responsibilities of his distinguished office. True, a judge has not an enviable position, for he frequently comes in for severe comment.

I take it if a judge understands his work, and the exhibitors realise that fact, they have confidence and submit graciously to the decisions.

Should judges give the reasons for accepting or rejecting an exhibit? The answer is "Yes". The award sheet should be filled, giving the reasons. The committee could then decide what use they should make of the judges' remarks. Their good judgment should direct them, either to affix a card or make the remarks known through the press. Undoubtedly the judges' work should be made public. I have known both of these methods adopted with good results. Until something of this kind is done, agricultural shows will not be the educational factor they are intended to be. It may be argued the method suggested will involve much work. True, but if the judges are well paid (which they ought to be) they should have a perfect knowledge of their work, and do it thoroughly. At present judges do not receive the remuneration the important position demands.

The Pastoral and Agricultural Societies' Union of New South Wales should have the power to enrol judges. There is much difficulty in securing the services of competent judges. Societies are often perplexed, and appointments made which are most unsatisfactory. The State Board should direct and control this responsible work. Fees should be fixed, qualifications ascertained, and provision made for the removal from the list of those judges who do not fulfil their appointments, or for the neglect of duty in any way. It is to be regretted the Railway Commissioners decline to give judges free passes by rail in the execution of their duties. Nevertheless, the committees of the different societies should pay out of their funds the judges' travelling expenses. In the meantime, no doubt, the Commissioners will see their way clear to make the concession if the single judge system is generally adopted.

My sympathies are with the promoters of the newly organised Chamber of Agriculture. May unqualified success crown their efforts. "Time, like a pitiless master, cries 'Onward.'" Then let "Onward" be our watchword. There may be difficulties and disappointments: such are common to all newly formed institutions. The thing to be desired is to get the people to take an intelligent interest, and let them see the importance of the undertaking. That it has an importance no reflecting mind will dispute.

Individually, I hail with pleasure the boon to be derived, and recognise fully the many possible benefits to be derived from the establishment of such an institution. It has interests in common with all things pertaining to Agriculture.

The value of the Chamber of Agriculture will not be realised at the start, but its usefulness will grow year by year until it becomes a power in the land.

## OPEN JUDGING.

By W. MUGGRIDGE.

It is gratifying to notice that during the past year many country shows have adopted the single-judge system, which is certainly an evidence of progress in the educational groove. When a single judge is appointed he has to depend solely upon his own knowledge, and this influences him to use much greater care in considering the points of an exhibit than when he could rely upon co-judges to assist him in arriving at a decision, and depend upon them to share the responsibilities of the position.

In a measure this self-reliance demands that a judge shall give himself reasons for every verdict, and so is he fore-armed to defend himself against adverse criticism by being prepared to explain the various characteristics or points which influence him in favour of or against any particular exhibit. Again, a single judge, being wholly responsible for the awards, is freed from the restraint which is sometimes placed upon one of a trio of judges who has to bow to a decision which is against his judgment. Therefore, a single judge is free to give reasons.

This system of giving reasons is plainly the only means of affording an education to the producer, and yet many exhibitors, owing to the promptings of a so-called "sportsmanlike" spirit, or from a commendable desire to assist the smooth-running of the show business, deny themselves of what should be the right of every exhibitor—the exercise of the privilege of asking the judge for the reasons which influence him to fix upon the ribbon winners. To raise this system of giving reasons to a higher value the institution of open judging might easily be enlisted, and to instance the necessity that actually exists for this reform I would refer to horse exhibits, as being within my province. With the owners or exhibitors within this section allowed to gather round the judge during the time that the animals were being judged, the actions of the responsible person would to a certain extent be followed advantageously by the exhibitors, and the judge's remarks would afford a certain amount of education or explanation to his audience. When the ribbons were placed, unsuccessful (or even successful) exhibitors could ask for full reasons, and have explained to them the location and definition of hereditary or other undesirable infirmities or shortcomings. There are many exhibitors and even breeders of equine stock who do not know what a side-bone, ring-bone, spavin, curb, cat-ham, bottle-rump, cow-hock, or calf-knee is, and it should be the duty of a judge to fully describe such undesirable features whenever an exhibitor should desire.

There is also a measure of satisfaction within the judge's reach under the system of open judging, for it guards him against being subjected to the criticism of exhibitors who arrive at their opinions from an unfair position—from outside the ring. A close inspection of exhibits by the judge is an absolute necessity, and it is almost as needful that the judging of the judge's work should be made at equally close quarters.

It would be unreasonable to suggest that a judge never makes a mistake; yet his honesty of purpose is not likely to be questioned if he can, by giving reasons, prove that he has conscientiously arrived at his decisions.

The time to ask for reasons is directly after the judge has made his awards, so that the points which influenced him are fresh in his memory, and the exhibits are available for comparison. The education of the producer has ever been the recognised aim of agricultural societies, and no better means of accomplishing this object presents itself than the adoption of the system of Open Judging and the giving of reasons.

## NEW SOUTH WALES CHAMBER OF AGRICULTURE.

### *Inaugural Meeting.*

A WELL-ATTENDED meeting was held at Tattersall's Chambers, Sydney, on Thursday evening, 16th April, for the purpose of inaugurating a Chamber of Agriculture for New South Wales, the work of organisation having, so far, been carried on by the Council of the Pastoral and Agricultural Societies' Union of New South Wales. Mr. C. H. Dight, M.L.A., President of the Union, occupied the chair. Among those present were—Hon John Kidd, Minister for Agriculture, Hon. W. Bennett, Minister for Forestry, Mr. W. S. Campbell, Director of Agriculture, T. H. Griffith, M.L.A. (Albury), M. Morton, M.L.A. (Shoalhaven), H. Hudson, Clyde Engineering Company, G. Maiden, the delegates attending the Pastoral and Agricultural Societies' Union Conference, several prominent poultry breeders, apiarists, and fruit-growers. Letters were read from the London Central Chamber of Agriculture, Brisbane Chamber of Agriculture, and apologies were received from a number of gentlemen unable to be present. The Chamber of Agriculture, Victoria, the Chamber of Agriculture, New Zealand, the Tasmanian Chamber of Commerce, as well as the Sydney Chambers of Commerce and Agriculture, wrote letters of good will towards the new Chamber.

The chairman said the only matter for surprise was that this State had not had a Chamber of Agriculture long ago. Victoria and Queensland both had chambers of the kind that had done good work. Co-operation was a good thing for everybody who was interested in the primary industries. The time had come when the producers of this State, if they wanted to achieve success, must co-operate. Only by co-operation could they make their voice heard with respect to legislation that affected their interests. He would urge upon all present to enrol themselves as members of the Chamber of Agriculture. The Chamber would start with very good prospects. The paid-up membership already reached 53.

The Hon. John Kidd (Minister for Agriculture) apologised for the absence of the Premier. He said it would be a good thing if the Pastoral and Agricultural Societies' Union would merge itself into the Chamber of Agriculture. The interests of both bodies were identical, with the addition that the latter Chamber would be the stronger by including all who were interested in the producing industry. He felt sure such a chamber would do much good. Much benefit would result from the interchange of opinions among those interested in similar industries. By co-operation they would doubtless be able to purchase the goods they required at a lower price, and also to get better prices for their own products. There were 120 agricultural societies throughout the State, representing a total membership of 23,000. The agricultural and pastoral industries were the most important in the State.

Mr. **Hudson** (Chamber of Commerce) said that a Chamber of Agriculture could not fail to do an immense amount of good. As far as his chamber was concerned, he could assure them that it would be anxious to assist them in their aims.

Mr. T. H. **Griffith**, M.L.A., said the object of the meeting was of the utmost importance. There were a great many directions in which a Chamber of Agriculture would be of service. It could assist in the importation of good stallions to improve the breed of horses. He thought we held too many shows in the State. The small shows were killing the large ones. If we had fewer shows and better ones, it would be better for all concerned.

Mr. P. F. **Madden** said a Chamber of Agriculture would assist all those engaged in working on the land for a living. The Chamber should be established on a broad basis, and should send delegates to other countries to obtain information and disseminate it among the farmers. Within the last few years not only had a large number of stock been lost, but the stock had also deteriorated. The Chamber would be able to obtain information as to the best drought-resisting grasses and the best indigenous trees to be preserved. It could not be expected that private individuals should be able to do this.

Mr. **Herbert Rumsey** applauded the movement, and hoped to see fruit-growers, apiarists, bee-keepers, and those engaged in what was termed the minor industries, join the Chamber in hundreds, and so help in placing it on a solid foundation.

Mr. **Loder** said that a Chamber of Agriculture here would comprise different committees to deal with different industries. It would have a pastoral committee, a fruit committee, a dairy committee, and others. They would also have a legislation committee to deal with legislation affecting the producing industries.

Mr. N. A. **Gatenby** (of Forbes) gave the meeting his experience of feeding seventy-five sheep to the acre on lucerne, and said the Chamber would have a beneficial effect in disseminating knowledge of this character throughout the State.

Other gentlemen present spoke in favour of the objects of the Chamber. A number of names of members were handed in, the total membership being seventy-three

*Election of Officers.*—The following officers were elected :—President, Mr. C. H. Dight, M.L.A.; Vice-Presidents, Messrs. P. H. Morton, P. Oakden, R. T. Keys, and R. Davidson, M.L.A. ; Treasurer, Mr. J. J. Miller ; Council, Hon. W. Bennett, M.L.A., Judge Hamilton, Messrs. W. Harris, L. L. Ramsay, M. Brown, W. H. Hall, F. W. Downes, E. Butcher, T. Bragg, H. J. Rumsey, B. Ferry, and W. H. Eyres.

It was decided that the election of the remaining thirteen members of the Council should be deferred until it was known what agricultural societies would join the Chamber. The first meeting of the Council to be held on April 29th, for the appointment of the sectional committees.

---

At the first meeting of the new Council, held on 29th April, it was agreed to only fill four seats out of the seven on the Sectional Committees, leaving the remaining three to be filled after the affiliation of the Union with the Chamber.

The following appointments were made :—

| | |
|---|---|
| *Finance* ... | Messrs. C. H. Dight, L. C. Ramsay, A. E. Rudder, and H. E. McIntosh. |
| *Cereal* ... | Messrs. T. Bragg, P. F. Madden, J. F. Chaffey, and W. Herbert. |
| *Pastoral* ... | Messrs. C. H. Dight, P. Oakden, N. A. Gatenby, and S. Bryce Beard. |
| *Dairy* ... | Messrs. J. G. Dight, Alex. Hay, F. W. Downes, and R. W. Alleson. |
| *Poultry* ... | Messrs. L. C. Ramsay, W. Harris, E. Butcher, and H. M. Hamilton. |
| *Apiarist* ... | Messrs. W. Hessell Hall, E. Tipper, W. Handcock, and W. Ager. |
| *Fruit* ... | Dr. Fiaschi, Messrs. Maunce Brown, H. J. Rumsey, and S. Fagan. |
| *Legislation* ... | Messrs. R. T. Keys, P. H. Morton, Dr. Fiaschi, and M. Brown. |

## REPORT ON THE AVERAGE YIELD PER ACRE OF MAIZE, POTATO, AND FRUIT CROPS.

THE Government Statistician invites the co-operation of readers of the *Agricultural Gazette* in the collection of information as to the yields of the various crops grown in New South Wales. Readers residing in districts in which maize, potatoes, and fruit (other than citrus) are grown will find in this issue a form—stamped and addressed—which they are requested to kindly fill in and return to the Government Statistician, Sydney, not later than 17th June.

# Irrigation.

W. J. ALLEN.

During the past few seasons, owing to the droughty conditions prevailing in many parts not only of this but of sister States, the attention of a large number of our farmers, fruitgrowers, and stockmen has been turned to the utilisation of any available supply of water which happens to be within reasonable distance of their land. Many of our pioneer irrigationists have had to contend with various disadvantages, and in nearly every district are to be found prophets of evil, who declare that owing to some peculiarity of soil, sometimes one thing and sometimes another, irrigation cannot be carried on successfully; that, owing, perhaps, to the presence in the water of certain chemicals, the trees and vegetables will be killed, or that the soil is of so porous a character that if one started to pump, the land would take it in like a sieve, and that no area of land could be covered at anything like a reasonable cost. There may be isolated places where criticisms such as these might apply, but, generally speaking, wherever fresh running water is available, and where it can be placed on the land, or, I may say, on the highest point of the portion proposed to be irrigated, at a reasonable cost and in a sufficient quantity to irrigate the land within a reasonable time, it will pay handsomely, and in place of killing either crop or trees, the effect will be exactly the opposite—that is, the soil will produce the best of its kind, whether it be fruit, lucerne, or vegetables, and crops are ensured during the dryest seasons.

## Water Channels.

In soils which are very porous it is often found advisable to construct either brick, cement, or concrete channels in place of running the water in earth drains, in order to save as much of the water as possible from seeping away.

In making a brick channel of a size sufficient to carry from twenty to thirty thousand gallons per hour (provided there is a fair fall), the dimensions would be about as follows, viz.:—

Depth, 10¾ inches ... ... ...
Width in clear at bottom, 9 inches ... } Inside measurements.
„ „ top, 25 inches ...

To construct such a channel it would require eight bricks to every 9 inches, or about 704 bricks to the chain. Before the bricks are laid it is necessary to have the soil well settled by running water through a furrow over the land where the proposed channel is to be; then after it is properly settled and levelled the channel is formed by cutting out the soil and forming good sides and bottom, same to be well pounded ready to receive the bricks or concrete, as the case may be. The bricks may then be laid, using a little cement to fill up any cracks found between them; or if the channel is to be of concrete, then lime concrete may be laid from 2 to 3 inches thick, according to the size of the channel, and to be then faced with a thin coating of cement.

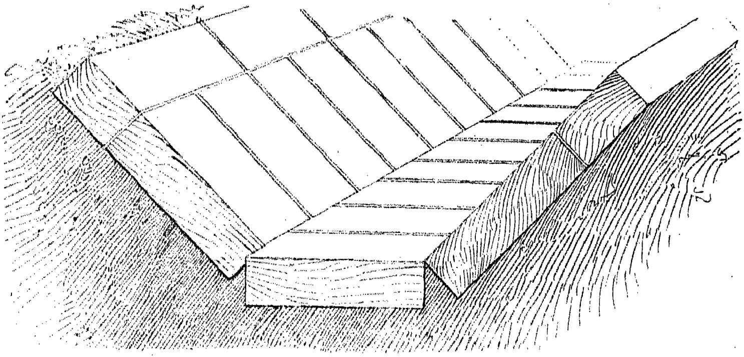


Fig. 1. Brick Channel.

In putting in such channelling it is necessary to have drops every chain or so according to the fall, so that the water may be either

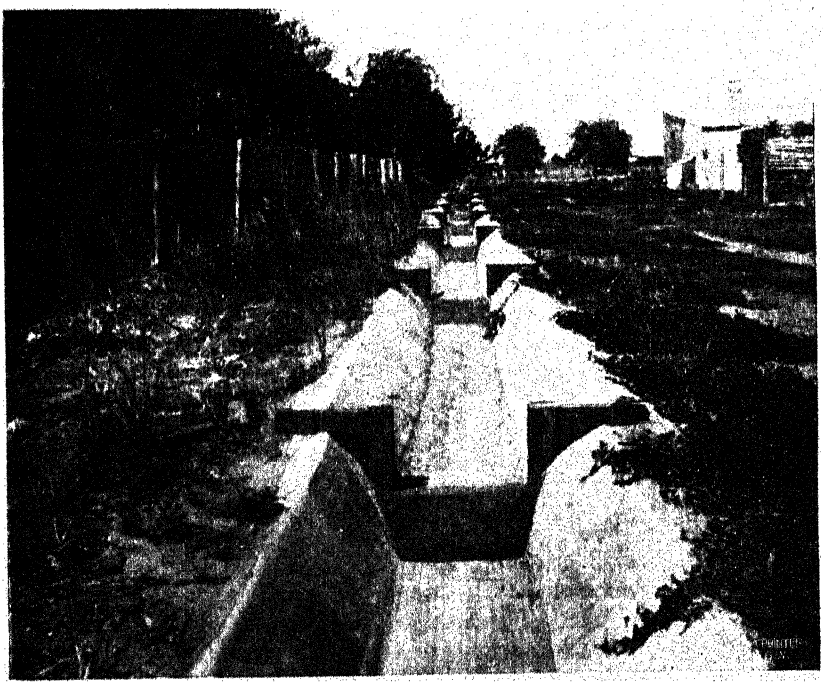


Fig. 2. Showing Sluice Boxes and Drops in a channel of concrete, such as is in general use at Mildura.

checked or stopped from going further, and turned into furrows used for watering either crops or trees. In such channels small sluice-boxes should be inserted at distances of about every 10 or 12 feet, these to be used for running the water out of the channels into the furrows, and the inside measurements to be from 2 inches to 3 inches in the clear, according to the quantity of water required.

In California, where good timber could be had at a reasonable cost, flumes made of redwood were largely used in place of concrete or brick channels, and at distances of every 6 or 8 feet there are 1½ inch to 2½ inch holes, over which is placed a slide of thin galvanized iron to open and shut as the case may be, thus allowing the water to flow out into the furrows until the part is well soaked, when it is closed.

In nearly every instance I would recommend running the water through furrows in place of flooding the land, as unless it be for lucerne, the latter method hardens and settles the land, and a greater quantity of water is required than by the furrow system, to do the same work. Therefore, in watering any fruit trees or vines, I would always recommend using the furrows, and exercising the greatest care to prevent the water from breaking out and flooding the land, more particularly around the base of the tree, as this might cause gumming, and in consequence it might be only a matter of time before the tree died.

The number of furrows required depends almost entirely on the condition of the soil. In irrigating trees which are planted twenty feet apart, from two to four may be required, and the water is usually allowed to trickle through for from four to twelve hours, according to the condition of the soil.

In growing hay crops we usually put the furrows from 4 to 6 feet apart. For vegetable and maize crops we usually run a furrow between each of the rows. I have seen amateur irrigationists run the water through and shut it off before it had had time to soak the soil, and of course the results were not up to expectation, and when I pointed out that they were not doing their work thoroughly, the reply was "Oh, yes, I am." The following season, however, the advantage of doing the work thoroughly when they had started was borne in upon them.

As soon as the furrows are dry enough to cultivate no time should be lost in doing this work, and where irrigation is applied to trees or vines the cultivator should be put to work and kept going until the land has received two thorough workings.

While water is a good thing to have, still great care must be exercised in using it only at the proper time; that is, to apply it only when it becomes necessary; and do not think that because water is available that it is possible to neglect the cultivation, as no greater mistake could be made. The motto of the fruitgrower should be to cultivate thoroughly, and use the water as seldom as possible; in lucerne growing, on the other hand, it might pay to irrigate every three or four weeks. No hard and fast rule can be laid down; the operator must be guided by prevailing conditions, and the peculiar characteristics of his soil and climate.

## Levelling the Land.

This is a very important factor where irrigation is practised, as, if the land is properly levelled before being planted with trees or vines, or sown to crops, there is comparatively little work afterwards in running the water in the most economical way. Where large tracts are to be levelled a Buck scraper, as described in the November, 1898, number of the *Agricultural Gazette*, would be the best implement to use.

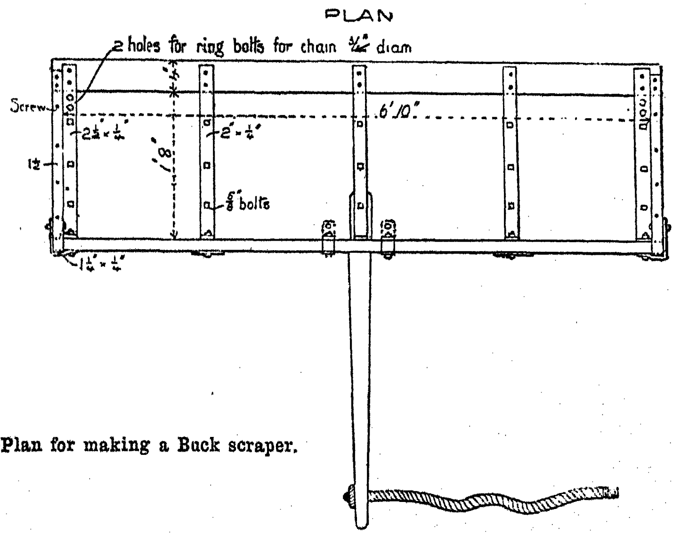


**Fig. 3.—Plan for making a Buck scraper.**

## Results of Irrigation.

In many countries irrigation is practised where trees or crops could not be grown without its aid, and it is in such climates that the very best results are obtained. In Riverside, California, before the advent of irrigation, the valley was to all intents and purposes a desert, so also was Ontario in the same State, and many other places not far distant. In Victoria the same might be said of the Mildura Settlement, where, without the use of water they have not been successful in raising one good crop of wheat in the last eight years, but where, with the aid of water, they have produced some of the best fruits and hay crops during these many years of drought. I saw there this year crops of hay standing which would average three tons to the acre, and the raisin and sultana crop is the best they have ever had.

Without going into details as to what suitable land can be made to produce under irrigation in this country, it has been amply demonstrated that it pays well wherever the water can be placed on the land at a reasonable cost. Along our rivers there is a lot of land which is suitable for irrigation. On the other hand there is land on which it would be almost a waste of money to put water; that is, on soils which are sun-burned and wind-scoured as also on some of our heavy black clay flats, such as are found lying along the lower Murrumbidgee and other rivers. However, we have ten times as much good land which could with profit be irrigated than at present we have water available for. It remains to be seen what can be done in the matter of storing some of that which yearly runs to waste. I have heard some of our pessimistic friends declare that irrigation here cannot be carried on the same as in California or America;—with this I do not agree. In California the water supply is very limited, and it is only by storing it in the mountains, and saving and utilizing all that they possibly can, that they have brought irrigation to the present high standard which it has attained there.

There is a lot to be done yet in this country, and it remains to be seen whether private enterprise will not see the advantages to be derived from the use of any water which may be available for growing crops of different kinds, to ensure against bad seasons, so that if the worst comes, they can at least carry over a good proportion of their stock, and be in a measure independent of the droughts.

There are many cases where private enterprise could not perhaps carry out a large scheme owing to the fact that they do not own the land where the water could be best conserved, or perhaps, if they did, they would be unable to get a right of way for the channelling from such position to the land where the water is intended to be used. Under these and similar conditions the Government could, perhaps, with advantage, step in nd do something for the good of the people and the country. To me it is a mystery why this most important subject has not heretofore received the attention it merits at the hands of farmers and fruitgrowers. Some of our more progressive growers are now putting in pumping plants, and the advantage of being able to apply water by artificial means during the dry season has been found such a boon by the few who have gone in for irrigation that in the near future

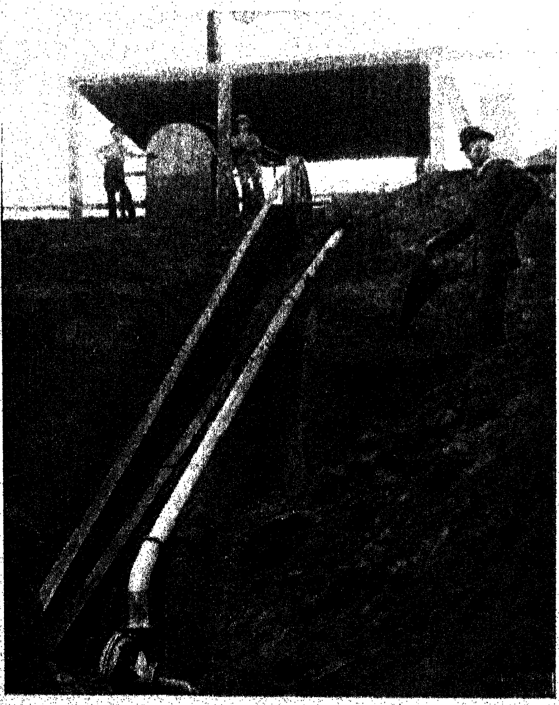


Fig. 4.—Mr. Sheppard's Irrigation Pump and Engine.

there are bound to be larger areas placed under water, and every hundred or thousand acres so watered will help to place the State in a better position from every standpoint.

Mr. R. M. Sheppard, of Westbank, Emu Plains, like most other fruitgrowers, has suffered considerable loss during the last few seasons of drought, as not only have his crops been smaller than if rains had been plentiful, but the size of the fruit has not been up to the standard of excellence which he aims to maintain, and thereupon after making many inquiries he decided upon the erection of a good pumping plant. As is usual in such cases, while many thought he might do well, others were of opinion that on such soil as he has (a deep sandy loam) irrigation would prove a failure, but the plant is now erected and its advantages have already been demonstrated.

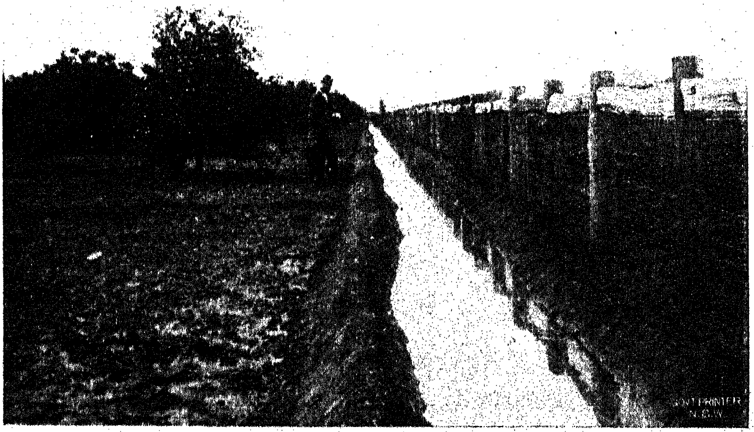


**Fig. 5.—The Main Channel along the top of Orchard.**

On taking levels, Mr. Sheppard found that his highest point was 45 feet above the water, and therefore the ordinary centrifugal pump was of little use, and he purchased a 5-inch centrifugal high service pump, a 10-h.p. colonial boiler, and an 8-h.p. horizontal engine. Owing to the periodical occurrence of floods in the Nepean River, he decided upon erecting his engine and boiler on the top of the embankment, and to drive the pump by means of a belt connecting the latter with the engine. The water is lifted 14 feet and delivered 31 feet (altogether 45 feet) through galvanized-steel pipes into a wooden flume, raised about 6 feet high at the point nearest the engine, and which conveys the water a distance of 165 feet to the highest point, from which it gravitates to any part of the orchard and farm, which comprises 32 acres of citrus, 10 acres of deciduous fruits, and 21 acres of farming and lucerne land.

The plant is capable of lifting up to 30,000 gallons per hour, and is in every way all that could be desired, being strong, running smoothly, and throwing a good head of water, which enables the owner to water his holding in the minimum time.

Fig. 5 is the main channel, full of water, at the head of the orange and lemon orchard, and from which the water is run into separate furrows all through the orchard.

The main channel runs across the highest portion of the holding for a distance of 35 chains, and from this main channel one or two lateral channels are made in order to avoid the necessity of running the water too great a distance, because if the run is too long the land lying at the top end of the furrow receives too much water before that at the bottom has had time to be thoroughly soaked. The greatest distance which the water has to run in any one furrow is 300 yards, and is shown in Fig. 6.

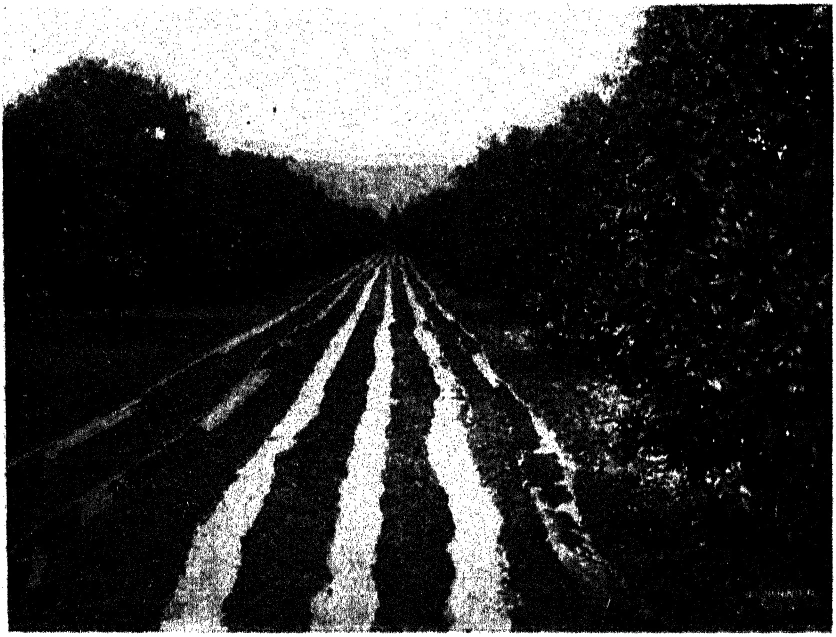


Fig. 6.—Water running in furrows between the trees.

This is a long distance to run water in a furrow, and there are few places where it would be found wise or profitable to run the water much more than half the distance.

Fig. 6 shows the water running through the furrows among the orange trees. The land is admirably adapted for irrigation, having a natural gentle fall from one end to the other. Fig. 7 shows the cultivators at work, working up the soil after an irrigation.

Mr. Sheppard finds that the effect of the water when applied is all that he could desire. The first water was applied to a 15-acre citrus orchard, which, at the time of the application, was in a wilted and drooping condition, and much of the fruit was small and pinched. Immediately after the application the trees revived, and at the time of my visit they were looking the picture of health, while the fruit was rapidly filling out to normal size. Mr. Sheppard is well satisfied with

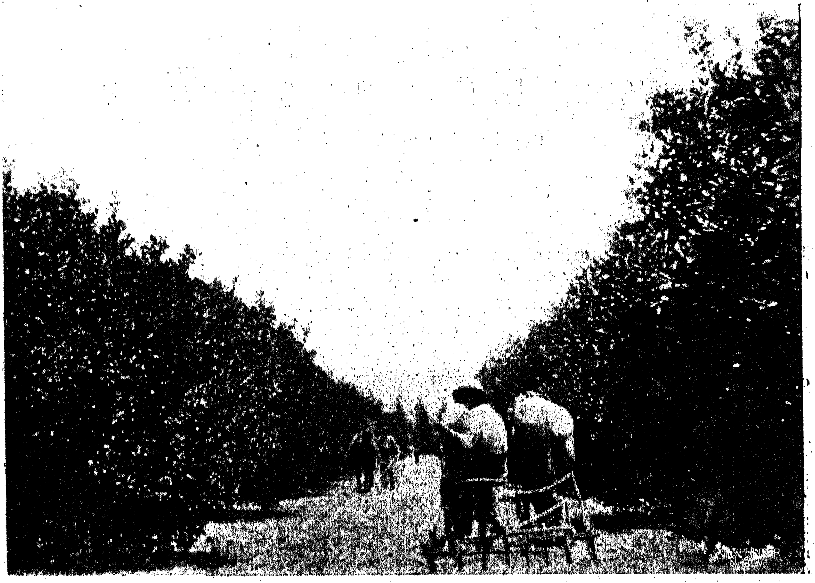


Fig. 7.—Cultivators stirring up soil after application of water.

his venture, and claims that the benefits to this crop alone will go a good way towards paying for half the cost of the irrigation plant.

Fig. 8 shows the plough at work in Mr. Sheppard's peach orchard.

Fig. 8.—Ploughing in Mr. Sheppard's Peach Orchard.

# Universal Nomenclature of Wheat

Continued from 850, Vol. XIII.

N. A. COBB.

PRACTICALLY the same series of wheats were examined for a third year as to the structure of the aleuron layer, and with the following results:

VARIETIES OF WHEAT ARRANGED ACCORDING TO THE NATURE OF THE ALEURON LAYER OF THE GRAIN.

The figures represent the percentage of area occupied by the contents of the aleuron cells when viewed radially.

(See plates VIII, IX, and X.)

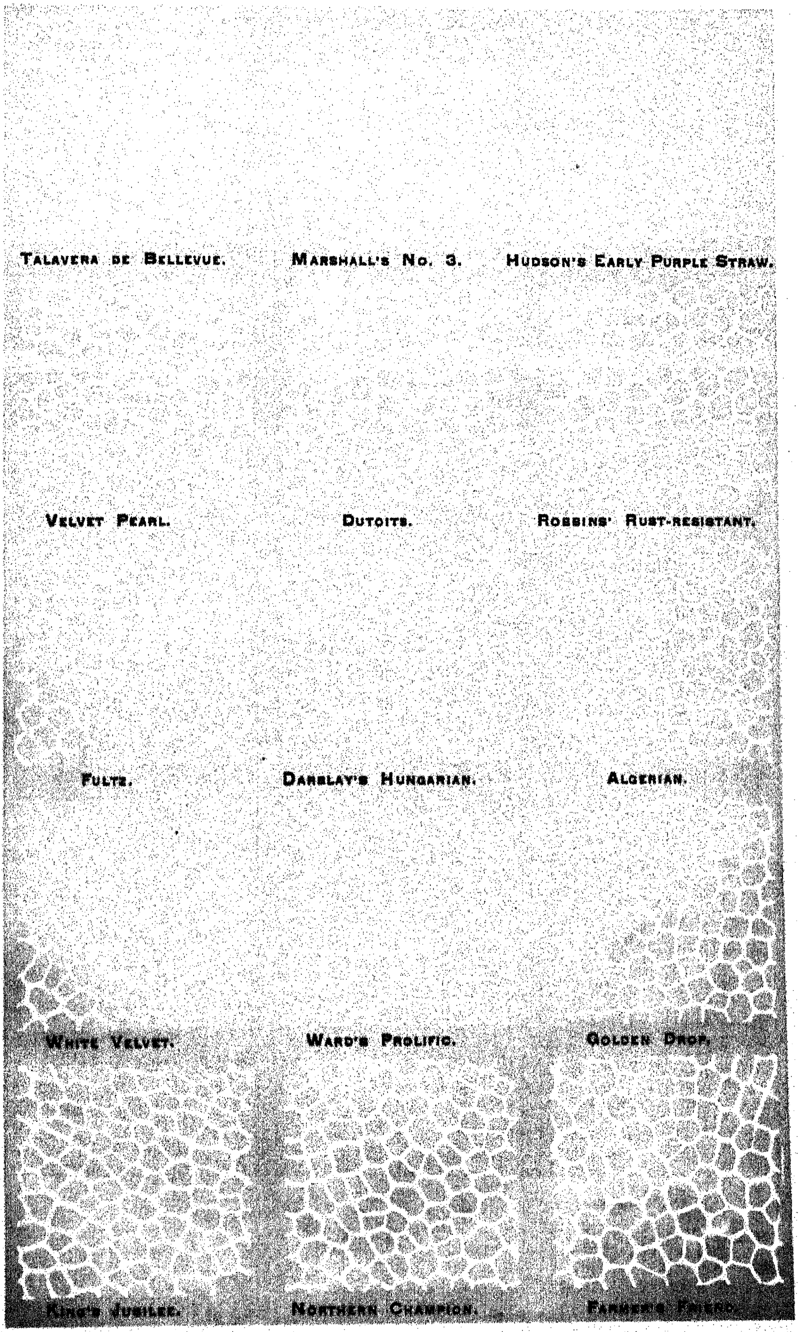
| | | | | | |
|---|---|---|---|---|---|
| Talavera de Bellevue | 70·2 | Steinwedel | 75·7 | Thomas' Rust Resistant | 79·1 |
| Marshall's No. 3 | 70·5 | Rattling Jack | 75·9 | Pringle's Defiance | 79·1 |
| Hudson's Early Purple Straw | 71·0 | Early Baart | 76·2 | Poland | 79·3 |
| Velvet Pearl | 71·1 | Brown eared Mummy | 76·3 | Early Para | 79·4 |
| Dutoits | 71·7 | Gore's Indian | 76·4 | Frampton | 79·5 |
| Robbin's Rust Resistant | 72·3 | Dallas | 76·5 | Anglo-Australian | 79·8 |
| Fultz | 72·4 | Allora Spring | 76·6 | Leak's Rust Resistant | 79·9 |
| Darblay's Hungarian | 72·5 | Red Straw | 76·8 | White Essex | 80·0 |
| Algerian | 73·0 | Bearded Hérisson | 77·1 | Zealand | 80·3 |
| White Velvet | 73·2 | Blount's Lambrigg | 77·3 | Medeah | 80·4 |
| Ward's Prolific | 73·9 | Canning Downs | 77·3 | Sicilian Square headed Red | 80·5 |
| Golden Drop | 74·3 | Hedgerow | 78·2 | Oakshott's Champion | 80·7 |
| King's Jubilee | 74·5 | French Early Bearded | 78·3 | Australian Talavera | 80·8 |
| Northern Champion | 74·6 | Saskatchewan Fife | 78·7 | Battlefield | 80·9 |
| Marshall's No. 8 | 74·7 | White Naples | 78·9 | Rieti | 80·9 |
| Farmer's Friend | 75·0 | Fillbag | 79·0 | Improved Fife | 81·0 |
| Steer's Early Purple Straw | 75·4 | White Lammas | 79·1 | Belotourka | 81·8 |

The preparations from which this series was photographed were put up in carbolic acid in about the same manner as in series two, but with the advantage of quicker and more uniform preparation and the entire removal of layers three and four of my previous enumeration, sometimes referred to as the inner bran. As a result of these improvements, the negatives were more uniform because the clearing was more uniform, and because there was no interference due to the presence of layers three and four. This latter item was one of considerable consequence in the case of certain varieties, such as Bearded Hérisson.

Now that the reader has a clear perception of the procedure adopted in the comparative examination of the aleuron layers of a series of varieties of wheat, it may be worth while to enter into details as to the method employed, which, of course, is a modification of that already described for a single preparation. The handling of fifty or more lots at a time, however, introduces elements not present in the simpler case of making a single preparation, the most important of which is the fact that the degree of clearing effected by the carbolic acid is dependent on the length of time the grains are soaked in water previous to entering the acid. Up to a certain point the soaking introduces no clearing difficulties, but beyond that point difficulties accumulate rapidly. Years of experience have taught me that where a large series of grains are to be examined in this way it is best to so manage as to have the whole operation over as rapidly as possible. With proper management fifty lots of three to five grains each may be soaked, brushed, cleaned, and placed in carbolic in the space of twelve hours—given a competent director and two or three assistants.

The central idea of the whole process is the introduction of the utmost speed and the systematic following up of each specimen, so that, as soon as it is softened by the water, it shall receive attention before the water shall have had time to penetrate the aleuron layer sufficiently to cause overclearing by the carbolic. This involves taking the specimens in rotation and working always on the softer ones.

Following through such a series soon teaches one that the different varieties behave differently, some soaking much more rapidly than others. Among the varieties here



Talavera de Bellevue. Marshall's No. 3. Hudson's Early Purple Straw.

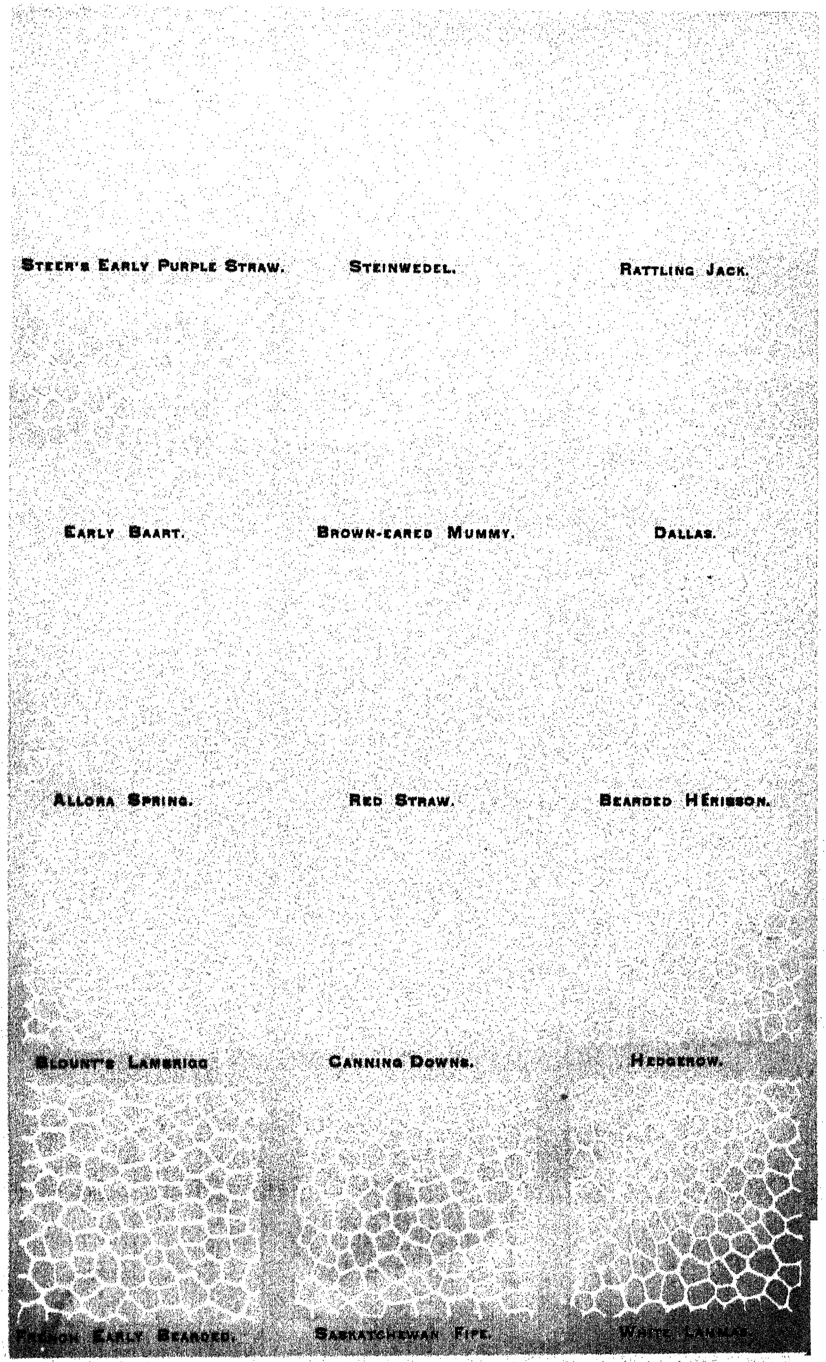
Velvet Pearl. Dutoits. Robbins' Rust-resistant.

Fultz. Dareklay's Hungarian. Algerian.

White Velvet. Ward's Prolific. Golden Drop.

King's Jubilee. Northern Champion. Farmer's Friend.

PLATE VIII.



STEER'S EARLY PURPLE STRAW. STEINWEDEL. RATTLING JACK.

EARLY BAART. BROWN-EARED MUMMY. DALLAS.

ALLORA SPRING. RED STRAW. BEARDED HÉRISSON.

BLOUNT'S LAMBRIGG. CANNING DOWNS. HEDGEROW.

FRENCH EARLY BEARDED. SASKATCHEWAN FIFE. WHITE LAMMAS.

PLATE IX.

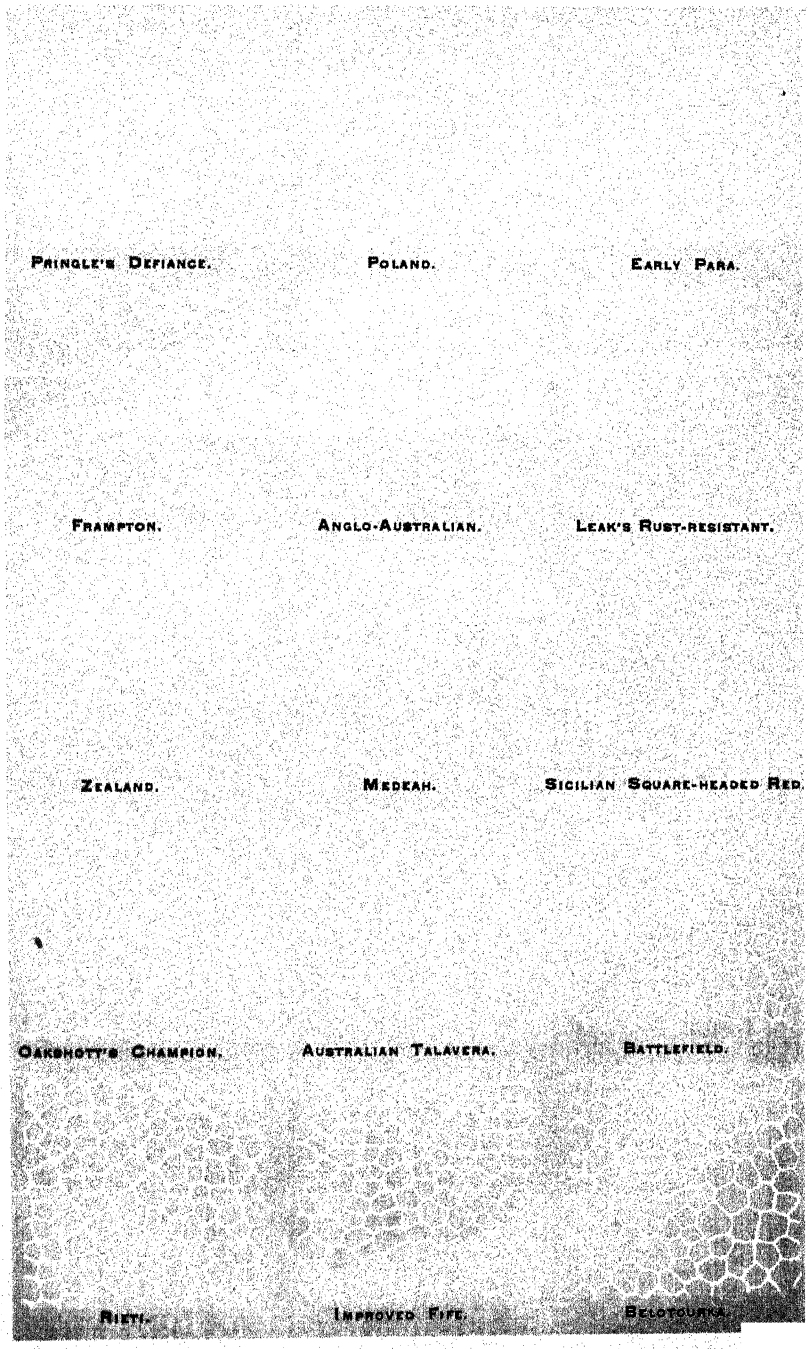

Pringle's Defiance.
Poland.
Early Para.
Frampton.
Anglo-Australian.
Leak's Rust-resistant.
Zealand.
Medeah.
Sicilian Square-headed Red.
Oakshott's Champion.
Australian Talavera.
Battlefield.
Rieti.
Improved Fife.
Belotourka.

PLATE X.

treated, Golden Drop is one that soaks rapidly. The Poulards soak and clear more rapidly and the Durums less rapidly than the average.

It is noticeable when layers three and four are imperfectly removed that the portions of the aleuron layer immediately beneath the unremoved patches of these layers clears less perfectly than elsewhere, showing that these layers are to some extent impervious to water. While they do not offer so much resistance to the penetration of water as do the membranes immediately beneath them, they evidently offer more than does the outer skin of the grain. This fact leads one to seek the complete removal of layers three and four if it is desired to secure perfect photographs.

## Preparation of a Series of Aleuron Layers.

Soak the grains for an hour, more or less, in water at 100 degrees Fah. Remove from the water and lay on a piece of blotting-paper, in order to remove superfluous moisture.

The outer skin should be removed with a pair of small sharp-pointed forceps, the best method being to seize on to the bristles of the brush end of the grain, and strip off the outer skin lengthways.

Holding the grain between the thumb and end of the forefinger with the brush end of the grain toward the right, brush it lengthwise with the stiffest kind of watchmakers' bristle brush. A fine stiff tooth-brush will answer the purpose, but not so well.

The removal of the inner bran is most easily accomplished by using the watchmaker's brush in such a manner that the bristles are not bent by the pressure of the right hand. Only that gentle pressure should be used which brings the ends of the bristles into action. As in most cases of brushing, so here, over-pressure, more or less defeats the end in view.

Should the inner bran prove refractory, moisten it and brush again. Once the grain becomes thoroughly dry through brushing, the removal of the inner bran is a tedious process. By occasionally touching the grain with the moistened finger of the right hand, the removal of the inner bran may be considerably expedited.

The inspection of the grain to test the removal of the inner bran is best accomplished by so holding the grain that it reflects some strong light, and then examining under a powerful magnifier.

When the inner bran has been removed, the grain acquires a shiny appearance, and with a powerful hand lens, it is possible to see the cells of which the aleuron layer is composed.

All this work on the bran can be accomplished within an hour after the grain is first put into water, and by this time it will usually be found that it is possible to cut the grain with a sharp knife or razor.

Cut away a boat-shaped piece from the back of the grain, and return it to the water to soak. Throw away the balance of the grain. After an hour, the boat-shaped piece will be found to be somewhat softened, and the end in view may be reached sooner by removing some of the flour-cells with a pair of sharp dentists' excavators, care being taken to avoid cutting through to the aleuron layer. After two to three hours more soaking, the remains of the flour-cells may be removed with the cut-off sable brush already described and figured. This is done under a magnifier.

As soon as most of the flour-cells have been removed, cut away the thick tissue in the neighbourhood of the embryo, leaving a uniformly thin piece to be finally brushed. Do not press much with the brush. Keep the bristles at right angles to the surface being brushed. It is convenient to use a Syracuse watch-glass, and so focus the magnifier being used that the brushing can be done on the left-hand slope of the concave of the glass. In this position it is easy to keep the brush working properly. The object should be to remove every trace of furriness due to the remains of the outer layer of flour-cells. Turn the aleuron layer inside out and this furriness may be seen in profile. So long as there is a distinct furry look to this profile, the brushing must be continued, for the presence of these remains of the flour-cells defeats the subsequent examination under the microscope, especially if photographs are to be taken. The best method of brushing I have tried is to move the brush in one direction for a few seconds, and then turn the object round, and thus reverse the motion, following these two operations by similar ones at right angles. The aleuron cells bulge out a little on the inner side of the layer, and it is necessary to pass the bristles in all directions into the creases made by the contiguous cells.

While the aleuron layer is possessed of considerable toughness, and may, therefore, be handled with a certain amount of roughness, it is better to proceed somewhat gently, because of the presence of certain aleuron cells that project a little into the floury part of the grain. Rough treatment breaks these projecting cells, and thus lowers the perfection of the resulting preparation.

The layer of aleuron cells should be passed into carbolic solution as soon as possible after being brushed, as otherwise changes begin to take place in the aleuron cells. If the aleuron layer come into carbolic within twelve hours of the first immersion, there are, as a rule, no marked changes in structure. The process may be so expedited that the object is in carbolic in four hours. When the process is long drawn out, the cells often clear so completely that it is impossible to observe the aleuron grains, or rather the aleuron grains themselves so alter as to become cleared by the carbolic.

When the objects have been brushed, it is best to lay them for a moment on some perfectly clean and freshly-brushed blotting-paper, so as to remove any superfluous moisture. After this a small amount of carbolic solution suffices for the clearing, which usually takes place in twelve to twenty-four hours. If examined too early the preparation seems altogether unsatisfactory, but will later be much improved. While the water of the tissues is still mixing with the carbolic, the emulsion-like nature of the combination prevents proper microscopic vision.

Aleuron layers that have been insufficiently brushed cannot be brushed while in carbolic.

The layers as they come from the brushing operations are curved, and hence do not lie well on the microscope slide. This defect may be cured by slashing them with a knife. In any case it is advisable to mount the layers under a pressure of 1 to 2 oz. My own method is to place a cylinder of lead, half an inch in diameter and 2 inches high, on the cover-glass, while the cement is being applied.

When this operation is well carried out, the results are remarkably good.

Speaking of the three series of preparations derived from three different years, we may say that although the methods used in the three cases were not identical, the results are comparable within useful limits. The greatest contrasts are brought out in the first table in which the glycerine method was used. The least contrast was brought out by the rapid carbolic method. It will be seen that the order assumed by the varieties in the various years is to a considerable extent harmonious.

If now we average the results of the three years, we should obtain a table of average values of higher utility than that for any single year. The following is such an average table:—

### VARIETIES OF WHEAT ARRANGED ACCORDING TO THE NATURE OF THE ALEURON LAYER—AVERAGE FOR THREE YEARS.

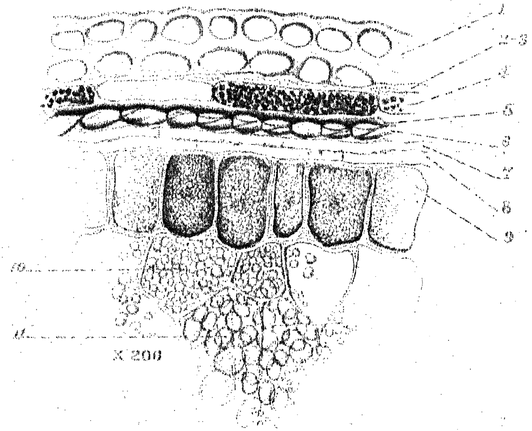
The figures represent the percentage of area occupied by the contents of the aleuron cells, when viewed radially:—

| | | | | | |
|---|---|---|---|---|---|
| Medeah | 78·9 | Robbins' Rust Resistant | 74·0 | Dutoits | 71·3 |
| Poland | 77·7 | Blount's Lambrigg | 73·9 | Red Straw | 71·2 |
| Improved Fife | 77·4 | Pringle's Defiance | 73·9 | Algerian | 71·0 |
| Belotourka | 77·3 | Early Para | 73·7 | Golden Drop | 70·9 |
| Oakshott's Champion | 77·2 | Dallas | 73·4 | Battlefield | 70·7 |
| Bearded Hérisson | 77·1 | Fillbag | 73·3 | Fultz | 70·6 |
| Marshall's No. 8 | 76·7 | Australian Talavera | 72·8 | Steer's Early Purple Straw | 70·6 |
| Hedgerow | 76·6 | Anglo-Australian | 72·8 | Rattling Jack | 70·4 |
| Zealand | 76·5 | Canning Downs | 72·8 | Gore's Indian | 70·1 |
| French Early Bearded | 76·0 | Hudson's Purple Straw | 72·5 | Steinwedel | 70·1 |
| Frampton | 75·2 | Velvet Pearl | 72·4 | Talavera de Bellevue | 70·0 |
| White Lammas | 74·9 | Little Club | 72·4 | Northern Champion | 69·4 |
| Leak's Rust Resistant | 74·5 | White Fife | 72·2 | Marshall's No. 3 | 69·2 |
| Sicilian Square-headed Red | 74·3 | Mummy | 72·2 | Thomas's Rust Resistant | 69·0 |
| Ward's Prolific | 74·2 | Early Baart | 72·1 | Galland's Hybrid | 68·8 |
| Farmer's Friend | 74·2 | King's Jubilee | 72·1 | Allora Spring | 68·5 |
| Darblay's Hungarian | 74·2 | White Essex | 72·1 | Stockton Defiance | 62·8 |
| Rieti | 74·1 | White Velvet | 71·9 | | |
| Saskatchewan Fife | 74·0 | Rattling Tom | 71·9 | | |

It will be seen from an examination of the constituent tables that this average table is not all that could be wished, for the reason that, in a considerable number of cases the average is for only two years. There are about ten cases whose value is lowered in this way. In one or two instances the result of a single test is recorded, but very little weight can be attached to these.

Notwithstanding these imperfections, I have found it interesting to examine the average table with reference to the position in it of various varieties, and in order to set forth some of the results of these examinations, I have caused the table to be printed in a variety of type on the adjacent page. In the first column the relation of the early and late wheats is shown with reference to the particular property of the aleuron layer expressed in the table. In the second column, in a similar manner, the Purple Straws are

TRANSVERSE SECTION (UPPER FIGURE) AND LONGITUDINAL SECTION (LOWER FIGURE) OF THE OUTER PART OF A GRAIN OF WHEAT OF THE PURPLE STRAW TYPE TAKEN NEAR THE MIDDLE OF THE GRAIN AT A TIME JUST PREVIOUS TO RIPENING, BUT WHILE THE GRAIN WAS STILL OF A GREENISH COLOUR; DOUBLY STAINED WITH EOSIN AND METHYL BLUE. THE LAYER 4 RETAINING ITS NATURAL GREEN COLOUR. THE SECTIONS CORRESPOND TO THE "BRAN" OF ORDINARY AUSTRALIAN MILLING.



*Cross Section:* 1.—*Outer layer of about two rows of cells which are oval in cross section. These belong to the outer skin and stain in methyl green and other aniline dyes.*

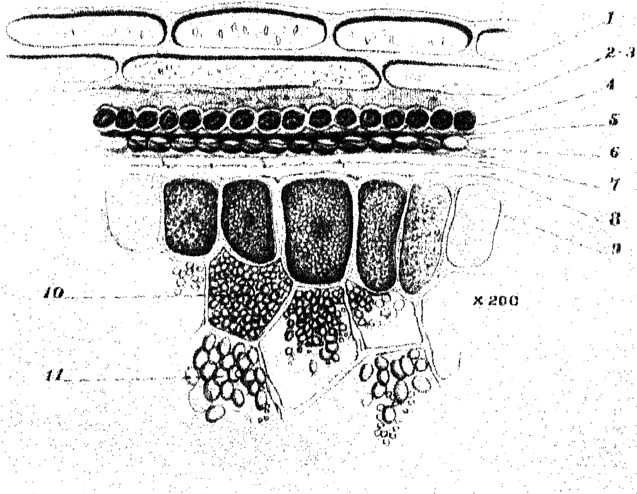
*2-3. A layer not very easily made out, thin and somewhat irregular, and not presenting at this stage of growth any distinct cellular structure. This is that portion which I suppose in the ripe grain to separate into two membranes. As a matter of fact it does show in this view some traces of division into two parts.*

*4.—The chlorophyll-bearing layer of the inner skin. These cells are here seen in longitudinal section, and display plainly the pits in their walls wherever the section allows the cell contents to escape.*

*5-6.—A layer of less thickness than No. 4, but the cells seen in oblique cross-section and no doubt of similar form to those of the last layer. The cells do not bear chlorophyll at this stage.*

*7-8.—Two layers lying next to the aleuron layer, and characterised by not staining nearly as strongly as the other layers. These are the two easily demonstrable membranes of the radial view. They are comparatively impervious to water.*

*9.—The aleuron layer.* *10-11.—Flour cells.*



*Longitudinal Section: 1.—The cell-walls of the epidermis are seen to be pitted. 2-3.—Layer No. 2-3 is less easily to be seen than in cross-section. 4. The chlorophyll bearing cells are seen in cross-section with their longer diameter (a trifle longer only) lying a little oblique. 5-6.—Cells again seen in cross-section, proving that they lie obliquely.*

contrasted with the Lammas wheats; and in the third column the relation of the nitrogenous composition of the grain to the particular feature on the aleuron layer is shown.

The information is set forth by the use of various types. Thus, in the first column, the late wheats are seen in *italics*, and the early ones in FULL-FACED TYPE. It will be seen that the late wheats are toward one end of the table, and the early ones toward the other end.

In a similar manner in the second column the Lammas wheats are set in *italics*, and the Purple Straws are seen in FULL-FACED TYPE. It will be seen that the Lammas wheats are toward one end of the table, while the Purple Straws are toward the other.

In the third column the wheats rich in nitrogen are set in *italics*, while those poor in nitrogen are set in FULL-FACED TYPE. It will be seen that the wheats rich in nitrogen are toward one end of the table, while the wheats poor in nitrogen are toward the other end of the table.

In other words, the relative earliness, relative richness in nitrogen, and other variety characteristics are recorded in the aleuron layer with discernible clearness, and with a degree of regularity that can only be ascribed to a law of growth which we can begin to see from these measurements alone, notwithstanding their very restricted nature.

| PURPLE STRAW AND WHITE LAMMAS TYPES. | | LATE AND EARLY WHEATS. | | HIGH AND LOW NITROGEN. | |
|---|---|---|---|---|---|
| Medeah | 78·9 | *Medeah* | 78·9 | *Medeah* | 78·9 |
| Poland | 77·7 | *Poland* | 77·9 | *Poland* | 77·7 |
| Improved Fife | 77·4 | *Improved Fife* | 77·4 | *Improved Fife* | 77·4 |
| Belotourka | 77·3 | *Belotourka* | 77·3 | *Belotourka* | 77·3 |
| *Oakshott's Champion* | 77·2 | Oakshott's Champion | 77·2 | Oakshott's Champion | 77·2 |
| Bearded Herisson | 77·1 | *Bearded Herisson* | 77·1 | Bearded Herisson | 77·1 |
| Marshall's No. 8 | 76·7 | Marshall's No. 3 | 76·7 | Marshall's No. 8 | 76·7 |
| Hedgerow | 76·6 | Hedgerow | 76·6 | Hedgerow | 76·6 |
| *Zealand* | 76·5 | Zealand | 76·5 | Zealand | 76·5 |
| French Early Bearded | 76·0 | FRENCH EARLY BEARDED | 76·0 | French Early Bearded | 76·0 |
| *Frampton* | 75·2 | Frampton | 75·2 | Frampton | 75·2 |
| *White Lammas* | 74·9 | White Lammas | 74·9 | White Lammas | 74·9 |
| *Laek's Rust Resistant* | 74·5 | Laek's Rust Resistant | 74·5 | Laek's Rust Resistant | 74·5 |
| Sicilian Square-headed—Red | 74·3 | *Sicilian Square-headed—Red* | 74·3 | Sicilian Square-headed—Red | 74·3 |
| Ward's Prolific | 74·2 | Ward's Prolific | 74·2 | Ward's Prolific | 74·2 |
| FARMER'S FRIEND | 74·2 | Farmer's Friend | 74·2 | Farmer's Friend | 74·2 |
| Darblay's Hungarian | 74·2 | Darblay's Hungarian | 74·2 | *Darblay's Hungarian* | 74·2 |
| Rieti | 74·1 | Rieti | 74·1 | Rieti | 74·1 |
| Saskatchewan Fife | 74·0 | *Saskatchewan Fife* | 74·0 | *Saskatchewan Fife* | 74·0 |
| Robbin's Rust Resistant | 74·0 | Robbin's Rust Resistant | 74·0 | Robbin's Rust Resistant | 74·0 |
| Blount's Lambrigg | 73·9 | *Blount's Lambrigg* | 73·9 | *Blount's Lambrigg* | 73·9 |
| Pringle's Defiance | 73·9 | *Pringle's Defiance* | 78·9 | *Pringle's Defiance* | 78·9 |
| Early Para | 73·7 | EARLY PARA | 73·7 | Early Para | 73·7 |
| *Dallas* | 73·4 | Dallas | 73·4 | Dallas | 73·4 |
| FILLBAG | 73·3 | Fillbag | 73·3 | Fillbag | 73·3 |
| *Australian Talavera* | 72·8 | Australian Talavera | 72·8 | Australian Talavera | 72·8 |
| Anglo-Australian | 72·8 | Anglo-Australian | 72·8 | Anglo-Australian | 72·8 |
| Canning Downs | 72·8 | CANNING DOWNS | 72·8 | Canning Downs | 72·8 |
| HUDSON'S EARLY PURPLE STRAW | 72·5 | Hudson's Early Purple Straw | 72·5 | Hudson's Early Purple Straw | 72·5 |
| Velvet Pearl | 72·4 | VELVET PEARL | 72·4 | VELVET PEARL | 72·4 |
| Little Club | 72·4 | Little Club | 72·4 | Little Club | 72·4 |
| White Fife | 72·2 | *White Fife* | 72·2 | White Fife | 72·2 |
| Mummy | 72·2 | *Mummy* | 72·2 | MUMMY | 72·2 |
| Early Baart | 72·1 | EARLY BAART | 72·1 | Early Baart | 72·1 |
| King's Jubilee | 72·1 | KING'S JUBILEE | 72·1 | King's Jubilee | 72·1 |
| *White Essex* | 72·1 | White Essex | 72·1 | White Essex | 72·1 |
| White Velvet | 71·9 | White Velvet | 71·9 | White Velvet | 71·9 |
| RATTLING TOM | 71·9 | Rattling Tom | 71·9 | Rattling Tom | 71·9 |
| Dutoits | 71·5 | DUTOITS | 71·5 | Dutoits | 71·5 |
| RED STRAW | 71·2 | Red Straw | 71·2 | Red Straw | 71·2 |
| Algerian | 71·0 | *Algerian* | 71·0 | ALGERIAN | 71·0 |
| Golden Drop | 70·9 | Golden Drop | 70·9 | Golden Drop | 70·9 |
| Battlefield | 70·7 | Battlefield | 70·7 | Battlefield | 70·7 |
| Fultz | 70·6 | *Fultz* | 70·6 | Fultz | 70·6 |
| STEER'S EARLY PURPLE STRAW | 70·6 | Steer's Early Purple Straw | 70·6 | Steer's Early Purple Straw | 70·6 |
| RATTLING JACK | 70·4 | Rattling Jack | 70·4 | Rattling Jack | 70·4 |
| Gore's Indian | 70·1 | GORE'S INDIAN | 70·1 | Gore's Indian | 70·1 |
| Stienwedel | 70·1 | STIENWEDEL | 70·1 | Stienwedel | 70·1 |
| *Talavera de Bellevue* | 70·0 | Talavera de Bellevue | 70·0 | Talavera de Bellevue | 70·0 |
| NORTHERN CHAMPION | 69·4 | Northern Champion | 69·4 | Northern Champion | 69·4 |
| Marshall's No. 3 | 69·3 | Marshall's No. 8 | 69·3 | Marshall's No. 3 | 69·3 |
| Thomas' Rust Resistant | 69·0 | Thomas' Rust Resistant | 69·0 | Thomas' Rust Resistant | 69·0 |
| Galland's Hybrid | 68·8 | Galland's Hybrid | 68·8 | GALLAND'S HYBRID | 68·8 |
| Allora Spring | 68·5 | ALLORA SPRING | 68·5 | ALLORA SPRING | 68·5 |
| Stockton Defiance | 62·8 | STOCKTON DEFIANCE | 62·8 | Stockton Defiance | 62·8 |

# Dairy Notes.

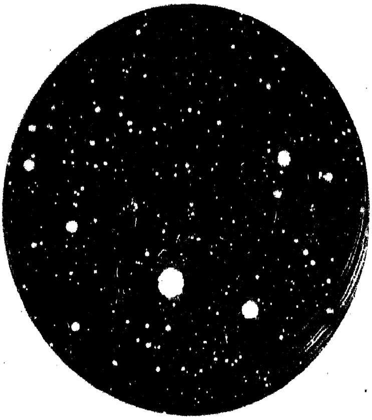
## BUTTER EXHIBITS AT ROYAL AGRICULTURAL SHOW, SYDNEY, 1903.

M. A. O'CALLAGHAN.

DAIRYING is not alone one of the staple industries of this State, but it is also an industry which gives employment to a large number of people; and it is the industry above all others at the present time which holds out good inducement for people to settle on the land. Under the circumstances it is doubtful whether dairy products receive sufficient attention at the Shows of the chief Agricultural Society of this State. The exhibits are scattered; the butter in one pavilion, and that a backward one, and the cheese exhibits in another. If the Show authorities visited the Agricultural Exhibition at Islington (London), they would see a very different state of things. Instead of eighty-two entries of butter stowed away in an out of the way pavilion, they would see 500 or 600 butter entries beautifully displayed in the main hall. At one time in the shows of the Royal Dublin Society, butter also seemed somewhat similarly out in the cold, and in 1894, the Irish Dairy Association showed what could be done by holding an exhibition, at which about 600 butters competed for the prizes. The following year this number was increased on. Then came the winter show which was held at the grounds of the Royal Dublin Society. This show was organised by various bodies in Ireland, with the object of demonstrating to the Royal Dublin Society the possibility of holding a successful winter exhibition. I acted as honorary secretary to the dairy section, and by a special effort of the Irish Dairy Association, about 400 butter exhibits were got together, although it was mid-winter. The entire exhibition turned out a success financially and otherwise, with the result that the Royal Dublin Society took over, and continued these winter exhibitions. This only goes to show what can be done by well-directed action by the people most concerned. The question arises whether the members of the Royal Agricultural Society specially interested in dairying should not endeavour to make a better representation of dairy products, and also to see that their wants are better catered for.

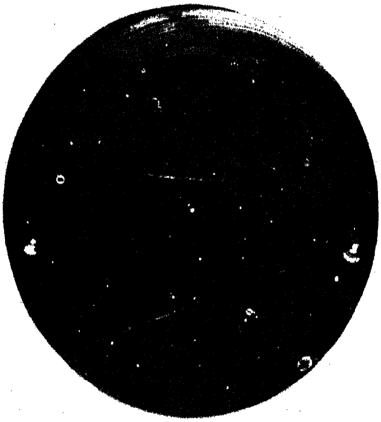
There is a horse committee on the Council of the Royal Agricultural Society, and why not a dairy committee. In fact it should be easily possible to hold an annual Dairy Show in New South Wales similar to those held in England and Ireland.

Six classes were provided for butter manufacturers at the recent exhibition, but only a total of eighty-two entries were received. Three



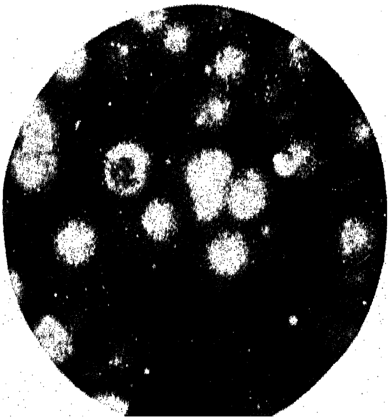
A

**A.** Illustrates the bacteriological condition of the butter that obtained first prize in the export class—viz., Illawarra Central creamery butter. The small white dots appearing on plate represent colonies of *B. acidi lactici*, and there were practically no other organisms present. This means that the cream was subject to lactic fermentation only, and it demonstrates exceptional cleanliness in the manufacture.



B

**B** Represents the second prize butter in this class, made at Crookwell factory. The same description practically applies to this as to the previous plate, the difference being that the lactic acid colonies were more numerous and more vigorous in Plate A. As a contrast to these excellent butters, I give—



**C**, which represents a butter entered in the class for private makers, and which was absolutely the worst butter in the show. It contained numerous colonies of *Oïdium lactis*, the organism which, in conjunction with lactic acid, produces fishiness.

of the classes were evidently unpopular, because only a total entry of fourteen was made. The other three classes had an entry of thirty-two, twenty and sixteen, or a combined total of sixty-eight. The most interesting of these was the Export Class, which provides that the butter shall be specially suitable for export. One of the conditions is that it must be held in cold store for six weeks before the date of judging. Thus the judge is enabled to form a reliable opinion as to how these butters would turn out on arrival in England after a six weeks' voyage. Another very interesting class is that for which the Fresh Food and Ice Company gives the prizes. This might really be termed the "Grocers' Class," because the conditions are such as to very severely test the keeping qualities of butter when held under somewhat similar conditions as a grocer holds a box of butter which is being sold. The butters are opened on a Wednesday morning (first day of show), and judged on the following Saturday. Meantime they are subject to the temperature of the butter pavilion, and this is pretty high during the day owing to some extent to the number of people in and about the pavilion. Under the circumstances it takes a butter of great body and texture to show to advantage on the Saturday. Loosely made watery butters, made from badly cooled cream, have no chance whatever of a prize in this class, even though their flavour may be all that is desirable. A butter, even of medium flavour but of very good body, will stand this test much better.

A butter to win in this class must be made from cream that has been well cooled, and as soon as possible after it has been separated; it must be churned at a low temperature, say 52° Fahr., and it must be worked in a room cool enough to ensure that the butter shall not get very soft while being worked. The water used for washing the butter should also be very cold, not more than 54 Fahr., otherwise the body and texture may suffer. The butters that got first and second places in this class were of great "body" and texture, the butter gaining second prize being almost as firm as if it had only just come out of a cold store. This class received the largest entry, viz., thirty-two, but of these only twenty-three put in an appearance. The only other class to receive fair support was that for butter suitable for "local consumption." This practically means a lightly-salted creamery butter that will keep fairly well for about ten days after it has been made.

A rather extraordinary feature of these competitions was that the same creamery, viz., the Illawarra Central Factory, Albion Park, won in the three principal classes here referred to, and obtained second place in the only other class in which it competed. In this latter class, viz., fresh butter in 1-lb. rolls or bricks, the first prize went to the same factory that won this prize for unsalted butter (open to colonial exhibitors only) at the last London Dairy Show, viz., New South Wales Creamery Company, Alstonville Factory.

*Defects.*—As an exhibition in manufacture the results of the examination of the butters were very satisfactory. This shows what our factory managers can do when they put forth their best efforts.

Compare these exhibits with the butters met with on our local market, and one wonders—can they have been turned out by the same people? Some easily-avoided defects in manufacture were, however, noticeable in some instances in the exhibits of some of our largest factories. Streakiness was the commonest sin, and one well-known factory forfeited a very good chance of first prize by this error. The butter was of excellent flavour and of good texture, but it was streaky. Yet nothing it seems can induce this factory to work its butter a second time. With two workings, and a buttermaker of experience, streaky butter is never met with. One working of salt butter, even by an experienced man, will generally produce either an over-worked butter or a streaky butter. Moral—work your butter twice, and thus avoid streakiness and greasiness.

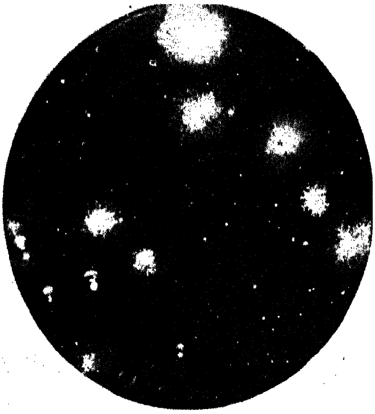
*Points awarded to the prize-winners.*—In the three principal classes there is a record of the points awarded to the various butters.

The maximum for a perfect butter was 100 points. The three placed butters in the export class obtained 95, 94, and 91½ points respectively, which is very good, considering that the show is held at a time of the year when it is difficult to get a very fine flavoured butter. The detailed points in this class were as follows:—

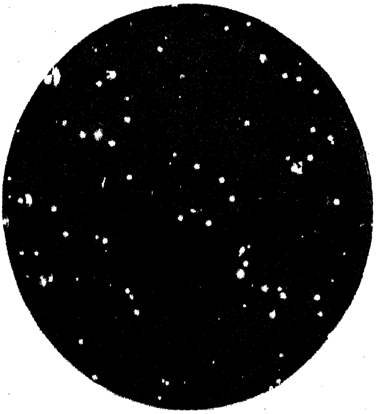
| Prizes. | Flavour. | Texture. | Colour and general market appearance. | Salting. | Packing. |
|---|---|---|---|---|---|
| 1 ... ... ... ... | 46 | 25 | 14 | 5 | 5 |
| 2 ... ... ... ... | 45 | 24 | 15 | 5 | 5 |
| 3 ... ... ... ... | 45 | 23 | 14 | 5 | 4½ |
| 4 ... ... ... ... | 43 | 23 | 14 | 5 | 5 |

In what I have termed the grocers' class the first prize butter scored 92 points; the second, 90 points; the third, 89; and the fourth, 87. The butter that won the first prize in this class was probably made from the same cream as that winning in the local consumption class. On this assumption it lost about 3 points during the four days that it had been open. This means that the flavour and texture must have been very sound when opened. On the other hand, many of the butters got very soft and greasy while awaiting adjudication.

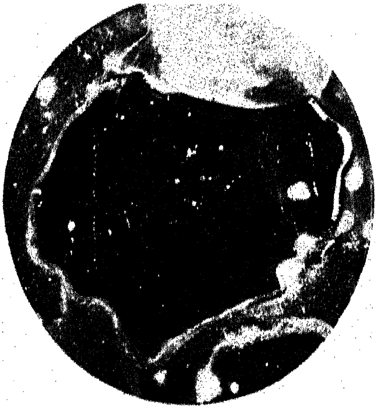
On the whole, these butters showed high-keeping quality, only about three exhibits being rancid after being held for six weeks in cold store. If all the output of the competing factories was only up to this show standard, what a happy position would New South Wales dairying occupy. This, however, is the position we should endeavour to attain.



**D.** Represents the second prize butter in loc consumption class. It will be seen that there a some very large colonies showing, somewhat r sembling in appearance the *Oïdium lactis* coloni in Plate C. They are, however, entirely differe in everything but appearance as colonies, th individual organisms being entirely dissimilar i shape. The organism in Plate D is identical wit Kurth's *Bacterium Zopfii.* It has no effect o milk, cream, or butter. There were practically n injurious organisms in this plate.



**E.** Represents the Victorian butter which wa awarded first prize in local consumption clas Bacteriologically speaking it was a good butter, a it contained no injurious organisms.



**F.** Represents one of the defeated butters. I will be seen that the gelatine all round the edg has been liquefied, this being the work of a injurious micro-organism which decomposes th casein present in butter, imparting to it a offensive odour.

## BACTERIOLOGICAL INVESTIGATION.

AFTER judging the various classes, I naturally became interested to know how the results would agree with the bacteriological condition of the various butters. By bacteriological condition I mean the number of micro-organisms present in the butter capable of decomposing its constituents, or the constituents of the cream from which it was made; or, in other words, it might be described as ascertaining the degree of cleanliness which characterised the manufacture of the butter from the time the milk was drawn from the cow until the butter was sealed down in dust-proof boxes. An examination of the butter only is not, however, a perfectly reliable guide as to the organisms that may have been present in the milk or cream, because there are certain organisms which injuriously ferment milk and cream, and which are not afterwards traceable in the butter made therefrom. They are destroyed by some substance elaborated during the growth of bacteria in the cream, probably by the lactic acid formed from the milk sugar. A bacteriological examination of the butters if freshly made is, however, a fairly reliable guide to the bacteria which were present in the cream during the ripening period, so that the conclusions drawn from such an examination by one experienced in the work are generally pretty accurate. From experience I have found that only one variety of micro-organism, namely, *bacillus acidi lactici*, is necessary in a perfect butter. Possibly there may be a flavour-producing organism other than this; but I have never yet met with it. Under conditions of great cleanliness it is possible to produce butter, practically speaking, containing no other organisms of fermentation save that mentioned. The butters from the Illawarra Central Creamery, which obtained the three first prizes above referred to, had very few bacteria present, except lactic acid producing bacilli, and these were in great numbers. The photographs of plate cultures I give representing the bacteriological condition of some of the butters should help butter-makers to understand the value of a pure lactic acid fermentation of the cream. Injurious fermentations are the result of dirt at some stage of the manufacture, and this should be avoided at any reasonable cost. Farmers who send milk to Sydney for sale as milk have to be very cleanly in their operations, in order to prevent the milk going sour before it reaches the consumer. Most farmers round Albion Park, where the first prize butter was made, send the morning's milk to Sydney, and as a consequence their methods of cooling and caring for the milk are much better than the average; hence, to a great extent, the absence of injurious micro-organisms in the butter shown by the Illawarra Central Creamery at the last Sydney exhibition.

# Hawkesbury Agricultural College and Experimental Farm.

## FIELD EXPERIMENTS WITH MAIZE.—SEASON 1902-1903.

GEO. L. SUTTON,
Experimentalist.

So favourable was the early part of the season, that many growers anticipated bountiful crops of maize. To such an extent was this opinion prevalent, that the local correspondents of the Sydney press sent reports to their respective papers that crops of 90 and 100 bushels per acre were likely to be common in this district. Unfortunately such anticipations were not to be realised. Early in January, 1903, just as the greater portion of the maize crop was in the tasselling stage, a heat wave set in, and continued almost throughout the whole of the tasselling period, with the result that the grain failed to form. Instead of record yields the crops in the district are almost entire failures. Some few crops planted in sheltered nooks escaped the general destruction and produced large yields. Such cases are exceptional and the area small, as may be judged from a paragraph which appeared in a local paper, dated 25th April, 1903. This stated that at Freeman's Reach a typical maize-growing locality, the largest maize crop of the season was 400 bushels, and that it averaged twelve bushels per acre. As the average yield of maize in this district in a normal season is about 70 bushels per acre, a comparison of the figures will at once indicate how unfavourable the past season has been for maize grown for grain.

Portion of Maize Experiments at H. A. College Farm, 1902-3.

The following experiments were carried out:—

- I. Trial of methods of planting and cultivation—
  - (*a*) Check planting *v.* Drill planting.
  - (*b*) Trench planting *v.* Level planting.
  - (*c*) Hilled cultivation *v.* Flat cultivation.
- II. Test of varieties—
  - (*a*) For grain.
  - (*b*) For fodder.

These experiments occupied an area of almost 5 acres. The methods adopted were such as would be practised if large areas of this crop were cultivated.

The land upon which the experiments were conducted is variable in character, and in no way is it a typical maize soil. The differences likely to arise from unevenness of the soil have been minimised by having the plots under trial composed of single drills adjacent to each other when possible, but in all cases as near to each other as their methods of cultivation would admit. To obtain the necessary area the pairs of drills were increased until they comprised the required area. Just prior to planting, 3 cwt. per acre of the following fertilizer was distributed in the drills by means of the fertilizer attachment on the maize drill:—Superphosphate, 5 parts; sulphate of potash, 2 parts; and dried blood, 1 part.

## Experiment I.

As might be expected in a district such as this where the main money crop is maize, and where such an extensive area is grown, much difference of opinion exists amongst growers as to best methods of planting and subsequent cultivation. Some advocate planting 3, 4, or more grains at regular intervals in the drill; others prefer planting single grains at regular but much shorter intervals in the drill. Advocates of both these methods differ in their opinions as to whether the grain should be planted at the bottom of a light furrow or trench, or on the level.

It is hoped by these and similar experiments extending over a number of years to throw some light upon these vexed questions.

Maize Experiments, H. A. College.
Check *v.* Drill Planting.

The drills in this experiment were 4 feet apart. The variety of maize used was the well-known Red Hogan.

*Section A.*—Check planting *v.* Drill planting.—By check planting is meant several grains planted together in the drill at regular intervals. By drill planting is meant single grains planted in a drill, but closer together than in the case of check planting. This trial occupied 1 acre.

Alternate drills were planted according to each system, in each case the seed was planted at the bottom of a light furrow about 4 inches deep. The crop was not hilled. When the plants were well above ground they were thinned out. In the case of those planted on the check system bunches of three stalks were left at regular intervals of 36 inches; in the case of drill planting single stalks were left at intervals of 12 inches. There were thus the same number of plants per acre under each system.

The crop was planted 3rd October, 1902, harvested 16th April, 1903. The results are as follow:—

*Section A.*—Check Planting and Drill Planting.

| No. of Drill. | Method of Cultivation. | Yield per Plot. | Computed Yield per acre. | No. of Drill. | Method of Cultivation. | Yield per Plot. | Computed Yield per acre. |
|---|---|---|---|---|---|---|---|
| | | lb. oz. | Bus. lb. | | | lb. oz. | Bus. lb. |
| 8 | Check ... | 13 6 | 7 49 | 17 | Drill .. | 19 0¼ | 11 0 |
| 9 | Drill .. | 15 6½ | 9 4 | 18 | Check .. | 16 14¾ | 9 54 |
| 10 | Check ... | 11 14 | 6 55 | 19 | Drill ... | 15 5 | 9 1 |
| 11 | Drill ... | 16 3¾ | 9 31 | 20 | Check .. | 11 4 | 6 37 |
| 12 | Check ... | 18 4¼ | 10 42 | 21 | Drill .. | 14 4¼ | 8 22 |
| 13 | Drill ... | 19 1 | 11 2 | 22 | Check ... | 10 11 | 6 16 |
| 14 | Check ... | 15 3¼ | 8 53 | 23 | Drill . | 13 10 | 8 1 |
| 15 | Drill ... | 18 9¼ | 10 52 | 24 | Check . | 16 10 | 9 44 |
| 16 | Check ... | 15 9 | 9 9 | 25 | Drill . | 18 0½ | 10 34 |

SUMMARY OF RESULTS.

Drill Planting ... ... ... ... ... ... 9 bush. 41 lb. per acre.
Check Planting ... ... ... ... ... ... 8 .. 27 .. ..

Increase in favour of Drill Planting ... 1 „ 14 „ „

This year the results are in favour of drill planting. It may be stated that the advantages of check planting are:—

I. The seed germinates better should a heavy shower crust the ground after planting.

II. A very much more uneven quality of seed can be used for planting with a machine.

III. The land can be drilled or marked out in squares or rectangles and the seed dropped at the corners; when this is done the crop can be cultivated both ways, a great advantage in dirty ground.

IV. Maize can be planted more expeditiously by hand.

Section B.—Planting at bottom of furrow (*i.e.*, trench planting) *v.* planting on level (*i.e.*, level planting). The common practice in this district is to plant at the bottom of light furrows. With the implements at present available this method necessitates the use of an additional team and plough at planting time. As the subsequent cultivation given to crops planted under either system may be either hilled or flat, plots planted under each system were cultivated on the flat and were also hilled for comparison. The results are as follow :—

*Section B.*—Trench planting *v.* level planting.

| No. of Plot. | Method of cultivation. | Hilled or Flat. | Yield per plot. | | Yield per acre. | | Increase (per acre). | |
|---|---|---|---|---|---|---|---|---|
| | | | lb. | oz. | bus. | lb. | bus. | lb. |
| 1 | Trench ... .. | Hilled ... ... | 21 | 11 | 12 | 44 | | |
| 3 | ,, ... .. | ,, ... ... | 21 | 3 | 12 | 27 | | |
| 5 | ,, ... ... | ,, ... ... | 23 | 5 | 13 | 41 | 4 | 39 |
| 2 | Level ... ... | ,, ... .. | 11 | 7 | 6 | 41 | | |
| 4 | ,, ... ... | ,, ... ... | 18 | 15 | 11 | 9 | | |
| 6 | ,, ... ... | ,, ... ... | 10 | 3 | 6 | 0 | | |
| 9 | Trench ... ... | Flat ... ... | 22 | 0 | 12 | 54 | | |
| 11 | ,, ... ... | ,, ... ... | 17 | 11 | 10 | 24 | | |
| 13 | ,, ... .. | ,, ... ... | 22 | 13 | 13 | 25 | 4 | 8 |
| 10 | Level ... ... | ,, ... ... | 13 | 15 | 8 | 12 | | |
| 12 | ,, .. ... | ,, .. .. | 13 | 11 | 8 | 4 | | |
| 14 | ,, ... ... | ,, ... ... | 13 | 14 | 8 | 10 | | |
| 16 | Level .. ... | Hilled .. ... | 13 | 9 | 7 | 55 | | |
| 20 | ,, ... ... | ,, ... .. | 11 | 13 | 6 | 53 | | |
| 18 | Trench ... .. | Flat ... ... | 32 | 1 | 18 | 50 | | |
| 22 | ,, ... .. | ,, ... ... | 29 | 3 | 17 | 9 | 10 | 31 |
| 24 | Trench ... ... | Hilled ... ... | 27 | 7 | 16 | 9 | | |
| 28 | ,, ... .. | ,, ... .. | 23 | 7 | 13 | 45 | 4 | 23 |
| 26 | Level ... .. | Flat ... ... | 18 | 3 | 10 | 40 | | |
| 30 | ,, ... ... | ,, ... ... | 17 | 11 | 10 | 23 | | |

The results are altogether in favour of trench planting, whether the crop is subsequently hilled or cultivated on the flat.

The disadvantages of trench planting are :—

I. Slightly more costly.

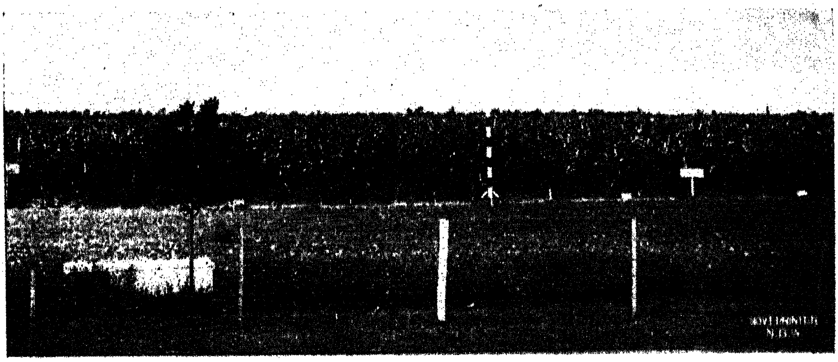
II. Should rain crust the soil before the plant is above ground, it is difficult to break the crust at the bottom of the trench; unless this be done, the young plant is often unable to break the crust and reach the light. When this happens, it necessitates replanting.

III. With the implements in common use, cultivation cannot be commenced as early as when the crop is planted on the level.

Section C.—Hilled *v.* Flat cultivation.—In this experiment both the trench and level systems of planting are compared. The crop to be hilled was so treated when the plants were about 18 inches to 24 inches high. The hilling given was not excessive, and was done by the hilling attachments of the Planet Jr. cultivator.

Subsequent to the hilling, showery weather for a few days was experienced, so that any ill effects due to this operation were not as likely to result as is the case when the hilling is performed during hot dry weather. The number of cultivations given to the crop under each method of planting was the same; in lieu of the cultivation given by hilling, the remainder of the crop was cultivated on the flat.

Owing to an accident, drills 32-38 were eaten down by sheep when about 12 inches high. This, no doubt, is the cause of the very low yields, and to some extent may have affected the difference obtained.



**Cultivation trials. Trench *v.* Level Planting. Hill *v.* Flat Cultivation.**

The results are as follow:—

*Section C.*—Hilled *v.* Flat cultivation.

| No. of Plot. | Method of Cultivation. | Hilled or Flat. | Yield per plot. | Yield per acre (computed). | Increase per acre. |
|---|---|---|---|---|---|
| | | | lb. oz. | bus. lb. | bus. lb. |
| 18 | Trench ... ... | Flat ... ... | 32 1 | 18 50 | |
| 22 | ,, ... ... | ,, ... ... | 29 3 | 17 9 | 3 2 |
| 24 | ,, ... ... | Hilled ... ... | 27 7 | 16 9 | |
| 28 | ,, ... ... | ,, ... ... | 23 7 | 13 45 | |
| 32 | Level ... ... | Hilled ... ... | 5 11 | 3 20 | |
| 36 | ,, ... ... | ,, ... ... | 5 11 | 3 20 | |
| 34 | ,, ... ... | Flat ... ... | 6 11 | 3 53 | |
| 38 | ,, ... ... | ,, ... ... | 5 11 | 3 20 | 0 16 |

These results indicate that when trench planting is adopted, hilling is unnecessary and injurious. In the portion of the experiment dealing with level planting, the results are so small, so similar to each other, that no deductions can be made.

Sometimes in a favourable season, when weeds are plentiful, it becomes necessary to hill the crop as the only means of eradicating the weeds. In such a case, hilling is then the lesser of two evils.

Some advocates of hilling claim that the hilled crop resists wind better than that cultivated on the flat. Such an assertion has not been confirmed by our experience this year.

## Experiment II.

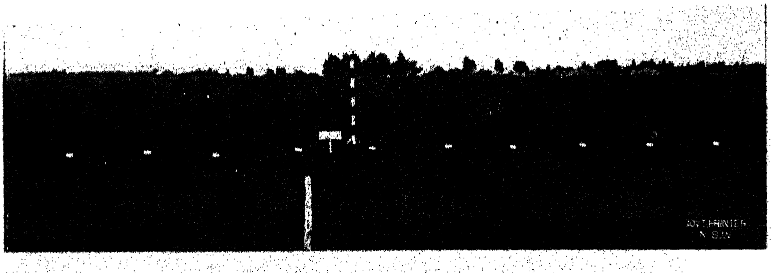
*Trial of Varieties.*—Each variety under trial was planted between two adjacent drills of the standard variety, Red Hogan. The yield of each variety can thus be compared with the average yield of the variety growing on either side of it. By expressing the average yield of these two drills as 100, the actual yield of the other varieties can be given as percentages of the yield of Red Hogan. By comparing these percentages with each other it is thought a much better idea of the actual merit of the different varieties will be obtained than by comparing the varieties with each other. Owing to the unevenness of the ground and to other causes it is often found that the difference in yield between two drills of the same variety, but situated in different parts of the same plot, is greater than the difference between two distinct varieties.

The trench system of planting was adopted in this experiment. The crop was not hilled.

The alternate drills of Red Hogan were planted with a maize drill. The other varieties were dropped and covered by hand; in order to have the conditions of planting as uniform as possible, the maize drill was run down the drill after planting and thus embedded the seed firmly in the soil.

*Section A.*—Trial of varieties for grain.—The crop was planted October 4, 1902. The drills were 4 feet apart. When well above the ground, the plants were so thinned out that single plants were 12 inches apart in the drills.

Drills 48 to 71, which were in the same plot as Experiment I., Section C., were accidentally eaten off by sheep when about 12 inches high. This no doubt affected the yields and caused an alteration in the relative positions of some of the varieties.



**Trial of Varieties for Grain. The drills of the standard variety. Red Hogan are unlabelled.**

The yield of drills 54 and 70 cannot be given, as most of the cobs on these two drills were stolen before thoroughly ripe. This is to be regretted, as both these varieties when growing in larger blocks in other plots proved exceptionally good. The results obtained are as follow:—

*Section A.*—Planted October 4, 1902.

| No. of Plot and Row. | Variety. | Seed obtained from— | Date Harvested. | No. of Days. | Yield per Plot. | Computed yield per acre. |
|---|---|---|---|---|---|---|
| | | | 1903. | | lb. oz. | bus. lb. |
| A 17— 1 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 11 4 | 6 35 |
| ,, 2 | Pride of the North ... | Horton & Co. .. | Jan. 27 | 115 | 35 7¾ | 20 51 |
| ,, 3 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 13 3 | 7 3 |
| ,, 4 | Pride of the North ... | ,, ... | Jan. 27 | 115 | 45 4 | 26 37 |
| ,, 5 | Red Hogan ... ... | ,, .. | Mar. 16 | 163 | 12 7 | 7 18 |
| ,, 6 | White Horse Tooth ... | ,, ... | Mar. 23 | 170 | failed to form grain. | |
| ,, 7 | Red Hogan ... ... | ,, ... | Mar. 16 | 163 | 11 15 | 7 1 |
| ,, 8 | Hickory King ... ... | Horton & Co. ... | Feb. 2 | 121 | 31 0½ | 18 15 |
| ,, 9 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 9 3 | 5 23 |
| ,, 10 | New White Ninety Day | Anderson & Co.. | Feb. 6 | 125 | 31 13¼ | 19 19 |
| ,, 11 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 9 11 | 5 39 |
| ,, 12 | New White Ninety Day | Horton & Co. .. | Feb. 6 | 125 | 34 7¼ | 20 16 |
| ,, 13 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 12 3 | 7 10 |
| ,, 14 | Iowa Silver Mine ... | Horton & Co. ... | Jan. 27 | 115 | 37 6 | 22 1 |
| ,, 15 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 10 7 | 6 8 |
| ,, 16 | E. E. Golden Flint ... | Horton & Co. ... | Feb. 7 | 126 | 26 8½ | 5 35 |
| ,, 17 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 10 3 | 6 56 |
| ,, 18 | Longfellow Dent ... | Anderson & Co.. | Jan. 29 | 117 | 39 6 | 23 11 |
| ,, 19 | Red Hogan ... .. | H. A. College ... | Mar. 16 | 163 | 14 13 | 8 14 |
| ,, 20 | Mastodon E. Dent ... | H. J. Rumsey ... | Jan. 24 | 123 | 38 5 | 22 32 |
| ,, 21 | Red Hogan ... ... | H. A. College .. | Mar. 16 | 163 | 15 0 | 8 47 |
| ,, 22 | Waterloo ... ... | H. J. Rumsey ... | Jan. 23 | 111 | 34 6½ | 20 15 |
| ,, 23 | Red Hogan .. ... | H. A. College ... | Mar. 16 | 163 | 16 3 | 9 30 |
| ,, 24 | Klondyke ... ... | H. J. Rumsey ... | Feb. 6 | 125 | 26 4¾ | 15 28 |
| ,, 25 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 14 11 | 8 36 |
| ,, 26 | E. Clarence River .. | A. A. McMillan, Clarence River | Feb. 16 | 135 | 31 5¾ | 18 27 |
| ,, 27 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 15 3 | 8 53 |
| ,, 28 | Abercrombie ... ... | R. Hough, Richmond. | Mar. 1 | 148 | 22 7 | 13 12 |
| ,, 29 | Red Hogan .. ... | H. A. College ... | Mar. 16 | 163 | 13 3 | 7 43 |
| ,, 30 | Star Leaming ... ... | Anderson & Co.. | Feb. 16 | 135 | 17 2 | 10 5 |
| ,, 31 | Red Hogan ... ... | H. H. College ... | Mar. 16 | 163 | 12 11 | 7 26 |
| ,, 32 | Yellow Dent ... .. | Anderson & Co.. | Feb. 16 | 135 | 22 8¼ | 13 15 |
| ,, 33 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 18 13 | 11 4 |
| B 19—48 | Golden King ... ... | Anderson & Co. | Mar. 16 | 163 | 7 0 | 4 7 |
| ,, 49 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 8 0 | 4 40 |
| ,, 50 | Hawkesbury Champion | G. M. Pitt, ... Sunnyside. | Mar. 16 | 163 | 7 11 | 4 29 |
| ,, 51 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 13 3 | 7 43 |
| ,, 52 | Yellow Hogan ... ... | ,, ... | Mar. 16 | 163 | 3 5 | 7 47 |
| ,, 53 | Red Hogan ... ... | ,, ... | Mar. 16 | 163 | 10 15 | 2 17 |
| ,, 54 | Riley's Favourite ... | U. S. A. ... | Feb. 1 | 120 | some cobs stolen. | |
| ,, 55 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 8 11 | 5 6 |
| ,, 56 | Red Hogan .. ... | ,, ... | Mar. 16 | 163 | 4 9 | 2 38 |
| ,, 57 | Red Hogan ... ... | ,, ... | Mar. 16 | 163 | 4 7 | 2 34 |
| ,, 58 | Horse Tooth ... .. | Williamson Bros. Jasper's Brush | Mar. 16 | 163 | 8 3 | 4 46 |
| ,, 59 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 4 15 | 2 15 |
| ,, 60 | Golden Drop ... ... | C. Hodgson, Tenterfield. | Feb. 3 | 122 | 7 8 | 4 23 |
| ,, 61 | Red Hogan .. .. | H. A. College ... | Mar. 16 | 163 | 4 5 | 2 30 |
| ,, 62 | Shoalhaven (1) ... ... | W. Anderson, Meroo Meadows. | Mar. 16 | 163 | 6 2 | 3 34 |
| ,, 63 | Red Hogan ... ... | H. H. College .. | Mar. 16 | 163 | 8 9 | 5 2 |
| ,, 64 | Shoalhaven (2) ... .. | W. Anderson, Meroo Meadows. | Mar. 16 | 163 | 12 15 | 7 35 |

| No. of Plot and Row. | Variety. | Seed obtained from— | Date Harvested. | No. of Days. | Yield per Plot. | Computed yield per acre. |
|---|---|---|---|---|---|---|
| | | | 1903. | | lb. oz. | bus. lb. |
| B 19—65 | Red Hogan ... .. | H. A. College ... | Mar. 16 | 163 | 6 11 | 3 52 |
| ,, 66 | Golden Nugget... ... | Horton & Co. ... | Mar. 16 | 163 | 8 5 | 4 50 |
| ,, 67 | Red Hogan ... ... | H. A. College ... | Mar. 16 | 163 | 13 11 | 8 3 |
| ,, 68 | Six Weeks Maize ... | ,, ... | Jan. 24 | 112 | 16 11 | 9 46 |
| ,, 69 | Red Hogan ... ... | ,, ... | Mar. 16 | 163 | 16 3 | 9 30 |
| ,, 70 | Clarke's Mastodon ... | ,, ... | Feb. 6 | 125 | some cobs stolen. | |
| ,, 71 | Red Hogan ... ... | ,, ... | Mar. 16 | 163 | 5 3 | 3 3 |

It will be noticed that the early varieties have proved the most prolific this season. This is owing, in some degree, to the fact that they had finished tasselling before the heat-wave and hot winds set in. The heat-wave was felt just as most of the later varieties were tasselling, a period in the growth of maize when adverse conditions are more severely felt than at any other stage. The whole of the difference is, however, not due to this cause, for it was noticed that some of the early varieties, planted later and growing on other plots, but tasselling during the heat-wave, cobbed very much better than the later varieties.

From the experience gained this year, I am inclined to think that, for poor soil, especially in dry seasons, the early varieties will be more suitable for grain than the late ones.

In the following table the yield of each variety has been calculated as a percentage of the average yield of the two drills of the standard variety growing on either side of it. It will afford an approximate means of comparing the merits of varieties.

*Section A.*—Table showing actual yields computed as percentages of the yield of the standard variety, Red Hogan.

| Name. | Obtained from— | Percentage Yield. |
|---|---|---|
| Pride of the North ... | ... Hawkesbury Agricultural College... | 353 |
| New White Ninety-day ... | ... Anderson & Co. ... ... ... | 337 |
| Pride of the North ... | ... Horton & Co. ... ... ... ... | 332 |
| Iowa Silvermine ... ... | ... Haywood Bros., Pambula ... ... | 330 |
| New White Ninety-day ... | ... Horton & Co. ... ... ... ... | 315 |
| Longfellow Dent ... ... | ... Anderson & Co. ... ... ... | 315 |
| Hickory King ... ... | .. Horton & Co. ... ... ... ... | 293 |
| E. E. Golden Flint .. | .. ,, ... ... ... ... | 257 |
| Mastodon E. Dent ... | ... H. J. Rumsey... ... ... ... | 257 |
| Waterloo ... ... ... | ... ,, ... ... ... ... | 221 |
| Early Clarence River ... | ... A. A. McMillan, Clarence River ... | 210 |
| Horse-tooth .. ... | ... Williamson Bros., Jasper's Brush... | 175 |
| Klondyke .. .. ... | .. H. J. Rumsey... ... ... ... | 170 |
| Shoalhaven ... ... | .. W. Anderson, Meroo Meadow ... | 170 |
| Golden Drop .. ... | ... C. Hodgson, Tenterfield ... ... | 162 |
| Abercrombie ... ... | .. R. Hough, Richmond ... ... | 158 |
| Yellow Dent ... ... | ... Anderson & Co. ... ... ... | 146 |
| Star Leaming ... ... | ... ,, ... ... ... | 132 |
| Six-weeks Maize ... ... | ... Hawkesbury Agricultural College... | 112 |
| Yellow Hogan ... ... | ... ,, ,, ... | 110 |
| Red Hogan .. .. .. | ... ,, ,, ... | 100 |
| Shoalhaven ... ... | .. W. Anderson, Meroo Meadow ... | 95 |
| Golden Nugget ... ... | ... Horton & Co. ... ... ... ... | 82 |
| Hawkesbury Champion ... | ... G. M. Pitt, Sunnyside ... ... | 73 |
| Golden King .. ... | . Anderson & Co. ... ... ... | 52 |
| Riley's Favourite... ... | ... United States of America ... ... | Cobs stolen. |
| Clarke's Mastodon ... | ... Hawkesbury Agricultural College... | ,, |
| White Horse-tooth ... ... | ,, ,, ... | Failed to form |

**Some of the Experimental Maize ready for Shelling and Weighing.**
[*Photo. by C. T. Musson.*]

The following table shows the same varieties in the order in which they mature.

VARIETIES arranged in Order of Maturity.

| Name. | Obtained from— | No. of days occupying Ground. |
|---|---|---|
| Waterloo | H. J. Rumsey | 111 |
| Six-weeks Maize | Hawkesbury Agricultural College | 112 |
| Pride of the North | ,, ,, | 115 |
| ,, | Horton & Co. | 115 |
| Iowa Silvermine | Haywood Bros., Pambula | 115 |
| Longfellow Dent | Anderson & Co. | 117 |
| Riley's Favourite | United States of America | 120 |
| Hickory King | Horton & Co. | 121 |
| Golden Drop | C. Hodgson, Tenterfield | 122 |
| Mastodon E. Dent | H. J. Rumsey | 123 |
| Clarke's Mastodon | Hawkesbury Agricultural College | 125 |
| New White Ninety-day | Horton & Co. | 125 |
| ,, | Anderson & Co. | 125 |
| Klondyke | H. J. Rumsey | 125 |
| E. E. Golden Flint | Horton & Co. | 126 |
| Star Leaming | Anderson & Co. | 135 |
| E., Clarence River | A. A. McMillan, Clarence River | 135 |
| Yellow Dent | Anderson & Co. | 135 |
| Abercrombie | R. Hough, Richmond | 148 |
| Golden Nugget | Horton & Co. | 163 |
| Red Hogan | Hawkesbury Agricultural College | 163 |
| Yellow Hogan | ,, ,, | 163 |
| Hawkesbury Champion | G. M. Pitt, Sunnyside | 163 |
| Horse-tooth | Williamson Bros., Jasper's Brush | 163 |
| Golden King | Anderson & Co. | 163 |
| Shoalhaven | W. Anderson, Meroo Meadow | 163 |
| ,, | ,, ,, | 163 |
| White Horse-tooth | Hawkesbury Agricultural College | 170 |

*Section B.*—Trial of varieties for Fodder.—In this trial the drills were 3 feet apart. The plants were thinned to 9 inches apart in the drills. Each variety was cut and weighed when the grain was well formed, and in the dough stage.

The details are set out in the following table:—

*Section B.*—Comparative trial of Maize for Ensilage. Planted November 4, 1902.

| No. of Plot and Row. | Variety. | Seed obtained from— | Height of Stalk. | Harvested. | No. of days. | Computed yield per acre. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Ft. | 1903. | | t. | cwt. | q. | lb |
| B 11— 1 | Red Hogan | H. A. College | 6½ | Feb 11 | 99 | 9 | 16 | 1 | 20 |
| ,, 2 | Pride of the North | H. A. College | 4½ | Jan. 22 | 79 | 4 | 14 | 1 | 4 |
| ,, 3 | Red Hogan | H. A. College | 5½ | Feb. 11 | 99 | 12 | 3 | 2 | 8 |
| ,, 4 | White Horse Tooth | H. A. College | 5½ | Feb. 11 | 99 | 7 | 17 | 0 | 16 |
| ,, 5 | Red Hogan | H. A. College | 5¾ | Feb. 11 | 99 | 9 | 8 | 2 | 8 |
| ,, 6 | Hickory King | Horton & Co. | 5½ | Jan. 30 | 87 | 10 | 1 | 0 | 12 |
| ,, 7 | Red Hogan | H. A. College | 5¾ | Feb. 11 | 99 | 13 | 3 | 0 | 24 |
| ,, 8 | Imp. Early Mastodon | Haywood Bros., Pambula. | 5 | Jan. 30 | 87 | 10 | 12 | 0 | 16 |
| ,, 9 | Red Hogan | H. A. College | 5½ | Feb. 11 | 99 | 11 | 7 | 3 | 12 |
| ,, 10 | New White Ninety Day | Anderson & Co. | 5¼ | Jan. 30 | 87 | 7 | 17 | 0 | 16 |
| ,, 11 | Red Hogan | H. A. College | 6 | Feb. 11 | 99 | 9 | 0 | 2 | 24 |
| ,, 12 | Iowa Silver Mine | Haywood Bros., Pambula. | 5½ | Jan. 1 | 58 | 7 | 13 | 0 | 24 |
| ,, 13 | Red Hogan | H. A. College | 6 | Feb. 11 | 99 | 9 | 16 | 1 | 20 |
| ,, 14 | Extra Early Golden Flint | Horton & Co. | 5 | Jan. 4 | 61 | 4 | 2 | 2 | 0 |
| ,, 15 | Red Hogan | H. A. College | 6 | Feb. 11 | 99 | 11 | 19 | 2 | 16 |
| ,, 16 | Longfellow Dent | Anderson & Co. | 5½ | Jan. 30 | 87 | 8 | 5 | 0 | 0 |
| ,, 17 | Red Hogan | H. A. College | 6¾ | Feb. 11 | 99 | 11 | 3 | 3 | 20 |
| ,, 18 | Mastodon E. Dent | H. J. Rumsey | 6 | Jan. 30 | 87 | 6 | 9 | 2 | 16 |
| ,, 19 | Red Hogan | H. A. College | 6 | Feb. 11 | 99 | 13 | 11 | 0 | 8 |
| ,, 20 | Waterloo | H. J. Rumsey | 5½ | Jan. 23 | 80 | 6 | 5 | 2 | 24 |
| ,, 21 | Red Hogan | H. A. College | 6 | Feb. 11 | 99 | 12 | 11 | 1 | 20 |
| ,, 22 | Klondyke | H. J. Rumsey | 5 | Jan. 30 | 87 | 3 | 10 | 2 | 24 |
| ,, 23 | Red Hogan | H. A. College | 6 | Feb. 11 | 99 | 13 | 11 | 0 | 8 |
| ,, 24 | Early Clarence River | A. McMillen, Clarence R. | 5½ | Feb. 11 | 99 | 14 | 2 | 3 | 12 |
| ,, 25 | Red Hogan | H. A. College | 5½ | Feb. 11 | 99 | 6 | 17 | 2 | 0 |
| ,, 26 | Abercrombie | R. Hough, Richmond. | 5¾ | Feb. 11 | 99 | 6 | 13 | 2 | 8 |
| ,, 27 | Red Hogan | H. A. College | 6 | Feb. 11 | 99 | 8 | 16 | 3 | 4 |
| ,, 28 | Star Leaming | Anderson & Co. | 6½ | Feb. 11 | 99 | 8 | 5 | 0 | 0 |
| ,, 29 | Red Hogan | H. A. College | 6½ | Feb. 11 | 99 | 11 | 7 | 3 | 12 |
| ,, 30 | Hawkesbury Champion | G. M. Pitt, Sunnyside. | 6½ | Feb. 11 | 99 | 8 | 12 | 3 | 12 |
| ,, 31 | Red Hogan | H. A. College | 6 | Feb. 11 | 99 | 9 | 12 | 2 | 0 |
| ,, 32 | Yellow Hogan | H. A. College | 6¼ | Feb. 11 | 99 | 8 | 16 | 3 | 4 |
| ,, 33 | Red Hogan | H. A. College | 6¼ | Feb. 11 | 99 | 13 | 7 | 0 | 16 |
| ,, 34 | Riley's Favorite | U.S.A. | 5¼ | Jan. 4 | 61 | 3 | 18 | 2 | 8 |
| ,, 35 | Red Hogan | H. A. College | 5¾ | Feb. 11 | 99 | 10 | 12 | 0 | 16 |
| ,, 36 | Horse Tooth | Williamson Bros. Jasper's Brush. | 6¼ | Feb. 11 | 99 | 8 | 12 | 3 | 12 |
| ,, 37 | Red Hogan | H. A. College | 6 | Feb. 11 | 99 | 10 | 8 | 0 | 24 |
| ,, 38 | Iowa Gold Mine | C. Hodgson, Tenterfield. | 5½ | Feb. 4 | 92 | 5 | 10 | 0 | 0 |
| ,, 39 | Red Hogan | H. A. College | 6 | Feb. 11 | 99 | 10 | 4 | 1 | 4 |
| ,, 40 | Shoalhaven | W. Anderson, Meroo Meadow. | 5½ | Feb. 11 | 99 | 8 | 8 | 3 | 20 |
| ,, 41 | Red Hogan | H. A. College | 5½ | Feb. 11 | 99 | 7 | 9 | 1 | 4 |
| ,, 42 | Golden Nugget | Horton & Co. | 4½ | Feb. 11 | 99 | 5 | 10 | 0 | 0 |

It will be noticed that for fodder the early varieties are not as suitable as the late ones.

Maize Experiments at H. A. College. Varieties for Fodder.

From a comparison of the results of this and the results obtained in Section A of this experiment, it is evident that the yield of grain of a variety is not in direct proportion to the length of stalk or the wealth of foliage it produces.

In the following table the yield of each variety has been calculated as a percentage of the average yield of the two drills of the standard variety growing on either side of it. It will afford an approximate means of comparing the merits of varieties :—

TABLE showing actual yield computed as percentages of the yield of the standard variety Red Hogan.

| Name. | Obtained from— | Percentage yield. |
|---|---|---|
| Early Clarence River | A. A. McMillan, Clarence River | 138 |
| Red Hogan | H. A. College | 100 |
| Shoalhaven | W. Anderson, Moroo Meadow | 96 |
| Hickory King | Horton & Co. | 88 |
| Imp. Early Mastodon | Haywood Bros., Pambula | 86 |
| Abercrombie | R. Hough, Richmond | 85 |
| Horse-tooth | Williamson Bros., Jasper's Brush | 82 |
| Iowa Silvermine | Haywood Bros., Pambula | 81 |
| Star Leaming | Anderson & Co. | 81 |
| Yellow Hogan | H. A. College | 77 |
| New White Ninety-day | Anderson & Co. | 77 |
| Hawkesbury Champion | G. M. Pitt, Sunnyside | 72 |
| White Horse-tooth | H. A. College | 72 |
| Longfellow, Dent | Anderson & Co. | 71 |
| Golden Nugget | Horton & Co. | 62 |
| Iowa Gold-mine | C. Hodgson, Tenterfield | 53 |
| Mastodon E. Dent | H. J. Rumsay | 52 |
| Waterloo | H. J. Rumsay | 48 |
| Pride of the North | H. A. College | 43 |
| Early Golden Flint | Horton & Co. | 37 |
| Riley's Favourite | U.S.A. | 33 |
| Klondyke | H. J. Rumsay | 27 |

The following table shows the same varieties arranged in the order in which they are ready for fodder.

Varieties arranged in the order of maturity.

| Name. | Obtained from— | No of days occupying ground. |
|---|---|---|
| Iowa Silvermine ... ... | ... Haywood Bros., Pambula ... ... | 58 |
| Riley's Favourite... ... | ... U.S.A.... ... ... ... ... | 61 |
| Extra Early Golden Flint | ... Horton & Co. ... ... ... ... | 61 |
| Pride of the North ... | ... H. A. College... ... . ... | 79 |
| Waterloo ... ... ... | ... H. J. Rumsey ... ... ... | 80 |
| Hickory King ... ... | ... Horton & Co. ... ... .. ... | 87 |
| Imp. Early Mastodon ... | ... Haywood Bros., Pambula ... ... | 87 |
| Mastodon E. Dent ... | ... H. J. Rumsey ... ... ... | 87 |
| New White Ninety-day ... | .. Anderson & Co. ... .. ... | 87 |
| Longfellow Dent ... ... | ... Anderson & Co. ... .. ... | 87 |
| Klondyke ... ... ... | ... H. J. Rumsey ... ... ... | 87 |
| Iowa Gold Mine ... ... | ... C. Hodgson, Tenterfield ... ... | 92 |
| Red Hogan ... ... | ... H. A. College... ... ... ... | 99 |
| White Horse-tooth ... | ... H. A. College... ... ... ... | 99 |
| Early Clarence River ... | ... A. A. McMillan, Clarence River ... | 99 |
| Abercrombie ... ... | ... R. Hough, Richmond ... ... | 99 |
| Star Leaming ... ... | ... Anderson & Co. ... ... ... | 99 |
| Hawkesbury Champion ... | ... G. M. Pitt, Sunnyside ... ... | 99 |
| Yellow Hogan ... ... | ... H. A. College... ... ... ... | 99 |
| Horse-tooth ... ... | ... Williamson Bros., Jasper's Brush... | 99 |
| Shoalhaven ... ... | ... W. Anderson, Meroo Meadow ... | 99 |
| Golden Nugget ... ... | ... Horton & Co. ... ... ... ... | 99 |

Summarised the results of the experiments conducted this season are as follow :—

I.—Drill planting produces larger yields than check planting.

II.—Trench planting produces larger crops than level planting.

III.—In a trial with trench planting, hilling the crop proved unnecessary and unprofitable. In a trial with level planting, an accident probably interfered with the results, which are so small and nearly equal that no deductions can be made.

IV.—The early varieties, some of them new, have proved more prolific as grain yielders than the late ones.

V.—When grown for forage the reverse is the case, the late varieties proving more prolific and suitable than the early ones.

## QUANTITY MEASUREMENTS.

CUTHBERT POTTS,

Lecturer in Chemistry and Physics.

THE following letter was received in reference to my article on Quantity Measurement in the April number of the *Agricultural Gazette*.

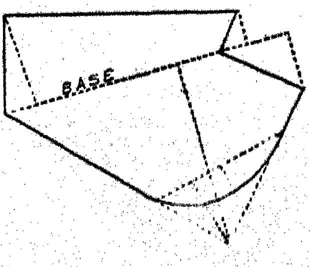
It asks for another article on the measurement of irregular blocks of land, which I propose giving in the next issue. The rest of the letter deals directly with my article and tabulates the results very neatly. On this account the letter is published intact.

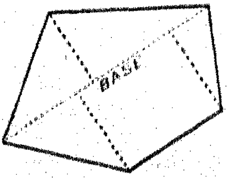
I wish to call particular attention to the last part of the letter dealing with the measurement of Dam volumes. In my article there was no mention made of cases where the bottom of the dam was uneven or the sides irregular. In the letter, the same method as I described, viz., the Prismoidal formula, has been used; but the parallel surfaces have been obtained by cutting the dam into as many parts as are necessitated by the irregularities of the bottom and sides by parallel vertical planes. A little consideration will convince one that this process could be conveniently used in estimating the quantity of earth to be excavated in dam construction (evidently the letter deals with such a case) or for drain construction, provided the levels and surface and bottom widths are found. To find these would involve the simple rules of levelling, but these have not so far been dealt with. In the case dealt with in my article I was estimating the quantity of water in the dam. In such a case the top surface must be horizontal, and it is only the unevenness of the bottom or irregularities of the sides that could make any difference.

Mr. W. McEachern, of Rosewood, writes:—I have read with interest your article on quantity measurements of haystacks, dams, &c., in the last issue of the *Agricultural Gazette* of New South Wales.

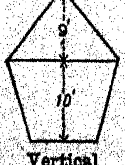
I think this article could be very suitably supplemented with simple rules for measuring and estimating the areas of paddocks having irregular boundaries. The present drought has, no doubt, proved how useful such information would be to many farmers who have had occasion to hire machines to reap crops which, although sown in a regular form, were, owing to the ravages of the drought and rabbits, reduced to very irregular forms by the time they were ready for harvesting.

The attached sketches show the irregular form of two crops cut by hired machines last season in this district, the boundaries being shown by full lines and the method of taking measurements by dotted lines.





Stack.



Vertical Section.

When reading your article it occurred to me that the rule you give for a circular stack might be more simply applied by omitting the multiplication by the constant $\frac{1}{4\pi} = \frac{7}{88}$, until the final result, which, being the cubic content of a square stack having a side equal to the circumference of the circular stack, is reduced to circular measurement by multiplying by $\frac{7}{88}$, or reduced to the cubic content of a square stack, having its sides equal to one-fourth of the circumference of the circular stack by multiplying by $\frac{14}{11}$.

For example—

Circle at Top is 0′, then $0 \times 0 = 0$

*Sums* $= 96 \times 96 = 9216$ — *Sum* × height above eaves $= 18432 \times 9 = 165888$

Circle at Eaves is 96′, then $96 \times 96 = 9216$

*Sums* $= 180 \times 180 = 32400$ — *Sum* × depth below eaves $= 48672 \times 10 = 486720$

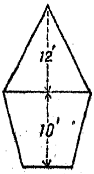
Circle at Ground is 84′, then $84 \times 84 = 7056$

*Sum* $\times \frac{1}{6} \times \frac{1}{4\pi} = \frac{65260}{6} \times \frac{7}{88} = 8652$ c. ft.

Thus the result, $\frac{652608}{6} = 108768$, is the cubic content of a square stack having one side at the ground, eaves, or top equal to the circles of the round stack at corresponding places, and is reduced to the cubic content of the round stack by multiplying by $\frac{7}{88}$, or to the cubic content of the corresponding square stack by multiplying by $\frac{1}{16}$, which, in the above example, would be $\frac{108768}{16} = 6798$ cubic feet.

The same method applies to an oval (or, more correctly, an elliptical) stack, the cubic content of which is equal to that of a rectangular stack with a pyramidal top, having its length and breadth equal to the long and short diameters of the elliptical stack, the cubic content being multiplied by the constant $\frac{\pi}{4} = \cdot7854$.

Stack.



Vertical Section.

For example—

Long and short diameters—

At Top are 0′ and 0′, then $0 \times 0 = 0$

*Sums* $= 30 \times 22 = 660$ — *Sum* × height above eaves $= 1320 \times 12 = 15840$

At Eaves are 30′ ,, 22′, then $30 \times 22 = 660$

*Sums* $= 54 \times 38 = 2052$ — *Sum* × depth below eaves $= 3096 \times 10 = 30960$

At Base are 24′ ,, 16′, then $24 \times 16 = 384$

*Sum* $\times \frac{1}{6} \times \frac{\pi}{4} = \frac{4080}{6} \times \cdot7854 = 6126$

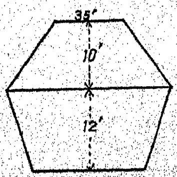
$\frac{46800}{6} = 7800$ = cubic content of a rectangular stack which has lengths and breadths corresponding to the long and short diameters used in this example, and

$7800 \times \cdot7854 = 6126$ = cubic content of the elliptical stack.

When the top of the stack is conical or pyramidal in form the top portion might be more simply calculated by the usual rule for such forms; but that involves the use of another rule, or, rather, the use of the same rule (the Prismoidal formula) applied by a different method.

In the examples given this formula is applied by the same methods up to and including the division by 6, the constant for the particular shape of stack being the only variable quantity.

The only form not included in the foregoing example is the oblong rectangular stack with a ridge; and the following is an example, having the same measurements as your example to Fig. 2.



Longitudinal, Vertical Section.

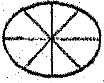
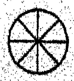
Length and breadth—

At Ridge are 35′ and 0′, then 35 × 0 = 0
Sums = 80 × 25 = 2000 } Sum × height above eaves = 3125 × 10 = 31250
At Eaves are 45′ and 25′, then 45 × 25 = 1125
Sums = 95 × 45 = 4275 } Sum × depth below eaves 6200 × 12 = 74400
At Ground are 40′ and 20′, then 40 × 20 = 800

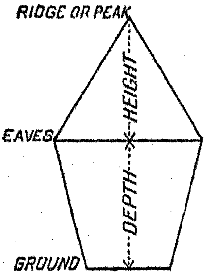
Sum × $\frac{1}{6}$ = $\frac{105650}{6}$ = 17608⅓ c. ft.

The method in this case is also the same as in the examples which have conical or pyramidal tops, even to the constant multiplier, which in this case is 1.

The constants used might be summarised as follow :—

| Shape of Stack. | Measurements used. | Constant multiplier. |
|---|---|---|
| Square stack | Length of side at ground, eaves, and top, vertical height above eaves and depth below eaves ... | 1 |
| Rectangular stack | Length and breadth at ground, eaves, and top; vertical height above and depth below eaves ... | |
| Circular stack | Diameter at ground, eaves, and top; vertical height above and depth below eaves ... ... ... | ·7854 |
| Elliptical stack  | Long and short diameters at ground, eaves, and top; vertical height above and depth below eaves ... | |
| Square stack | Length right round stack at ground, eaves, and top; vertical height above and depth below the eaves... | $\frac{1}{16}$ |
| Circular stack  | Length right round stock at ground, eaves, and top; vertical height above and depth below the eaves... | $\frac{7}{88}$ |

General formula for use with above measurements and constants—



Product of measurements at top ... ... ... ...
Product of sum of corresponding measurements at top and eaves ... ...
Product of measurements at eaves ... ... ...

} *Sum* of the three products × height above eaves ... ... ...

Product of measurements at eaves ... ... ...
Product of sum of corresponding measurements at eaves and ground ...
Product of measurements at ground ... ... ...

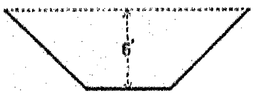
} *Sum* of the three products × depth below eaves ... ... ...

} *Sum* × $\frac{1}{6}$ × constant = cubic content.

In the case of a tank, where the measurements of the top and bottom areas and average depth are sufficient to give the cubic content, as in the example you give to Fig. 4, I generally use the method of the sums of the thirds and sixths of one set of measurements, the breadths or the lengths according as to which are more suitable; but in order to conform, as far as is possible, to one method of applying the Prismoidal formula, the method used in your example is better.

I have had occasion to measure several tanks in this neighbourhood lately, and in every case the top and bottom areas were so uneven, and so far from being parallel, that in order to obtain accurate results it was necessary to measure the average breadths and depths of several vertical and parallel cross-sections.

I give an example of applying the P. formula, without finding and using the multipliers, for four times the middle area, as applied to your example of a tank, Fig. 4; also, an example of systematic tabulations, as applied to measured cross-section when the use of such is necessary.



**Cross Section of Tank.**

In the latter case the breadth or depth of each cross-section is the average of as many measurements as the uneveness of the bottom, top, or sides may render necessary. In the case of the breadth, the half sum of the top and bottom breadths will generally be near enough for the average breadth.

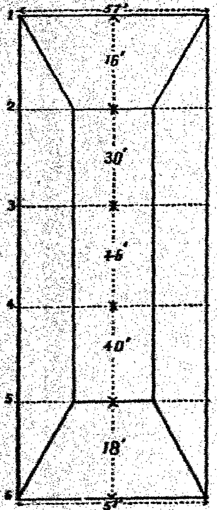
Example of tank, from top and bottom measurements, as in your example to Fig. 4.

Length and breadth at Top are 50′ and 36′, then $50 \times (\frac{36}{3} + \frac{30}{6}) = 50 \times 17 = 850$
Length and breadth at Bottom are 40′ and 30′, then $40 \times (\frac{30}{3} + \frac{36}{6}) = 40 \times 16 = 640$

} *Sum* × depth = $1490 \times 6 = 8940$

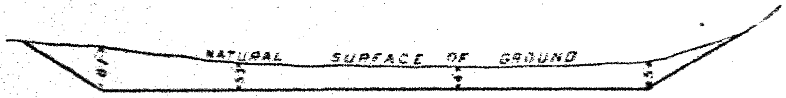
In this example the thirds and sixths of the breadths are used, and each being exactly devisable by 3 and 6 simplifies the multiplication.

Method of calculating content of Tank from measurements of cross-sections.



**Tank.**
**Sketch Plan Overall.**

| | | | |
|---|---|---|---|
| Breadth and depth of No. 1 Section are 57' and 0', then.. | 57 × 0 = 0 | | |
| *Sums* of breadths and depths of Nos. 1 and 2 Sections | = 104 × 5 = 520 | *Sum* × distance between Sections Nos. 1 and 2 = 755 × 16 = 12080 ... | |
| Breadth and depth of No. 2 Section are 47' and 5', then | 47 × 5 = 235 | | |
| *Sums* of breadths and depths of Nos. 2 and 3 Sections | = 93 × 9 = 837 | *Sum* × distance between Sections Nos. 2 and 3 = 1256 × 30 = 37680 ... | |
| Breadth and depth of No. 3 Section are 46' and 4', then | 46 × 4 = 184 | | |
| *Sums* of breadths and depths of Nos. 3 and 4 Sections | = 91 × 9·3 = 846 | *Sum* × distance between Sections Nos. 3 and 4 = 1268 × 46 = 58328 ... | *Sum* × $\frac{1}{6}$ × $\frac{1}{27}$ = $\frac{205484}{6 \times 27}$ = 1268 c. yards. |
| Breadth and depth of No. 4 Section are 45' and 5·3', then | 45 × 5·3 = 238 | | |
| *Sums* of breadths and depths of Nos. 4 and 5 Sections | = 89 × 14 = 1246 | *Sum* × distance between Sections Nos. 4 and 5 = 1867 × 40 = 74680 ... | |
| Breadth and depth of No. 5 Section are 44' and 8·7', then | 44 × 8·7 = 383 | | |
| *Sums* of breadths and depths of Nos. 5 and 6 Sections | 101 × 8·7 = 879 | *Sum* × distance between Sections Nos. 5 and 6 = 1262 × 18 = 22716 ... | |
| Breadth and depth of No. 6 Section are 57' and 0', then | 57 × 0 = 0 | | |



**Central Longitudinal Section of Tank.**

## FARM NOTES FOR THE HAWKESBURY DISTRICT—JUNE.

H. W. POTTS.

THE main sowings of cereals are now almost completed, and probably would be only for the favourable rainfall fall in April of 2·80 inches and the abundant showers in May. These delayed ploughing, and left more work to be finished this month in the direction of late crops of oats for hay, barley and vetches. With ground likely to be wettish during winter it will be a profitable course to manure oats with one cwt. of sulphate of ammonia per acre. In other cases where the earlier sown oats are backward they might be materially assisted with a top dressing of 1 to 1½ cwt. per acre of nitrate of soda. When it is considered that oaten hay is superior from a food-value standpoint to barley or wheat too much provisions cannot be made to render this valuable crop as prolific as possible.

In so far as existing crops are concerned, the favourable weather has brought them along in excellent condition. Where the land is good and the crop shows evidences of rankness it will be good policy to feed it down. This affords better subsequent results both for grain and hay.

In all drilled crops it is best to keep the surface well broken with the cultivator, or where the crop has been broadcasted use the harrow.

To combat the effects of the recent drought it will be advisable to to pay some attention to green manuring this winter, particularly with leguminous plants, such as common field peas, beans, crimson clover, and vetches, which will act as catch crops in spring, and further enrich the soil with nitrogen so valuable for potato and other crops to follow. Apart from this, these crops, also rape, are most serviceable for feeding sheep in July and August. They grow fairly well in the winter months.

*Turnips, Swedes, Field Cabbages, Kale, Rape, &c.*—These crops, taking advantage of the good season, are growing in the most luxuriant and sturdy manner. They require constant attention now to thin them out sufficiently; and cultivate to prevent the crowded plants becoming weak and spindly.

*Onions.* Seedlings 3 or 4 inches high from the early sowings are sufficiently grown, and may now be planted out. No better weather could be selected than that prevailing this season. The soil should be fairly rich, sandy, and well-drained. Land that has been occupied with some leguminous plant or crop is best, and well tilled to bring into its finest condition. A sheltered situation is advantageous. Cut off the top leaves where they join the stems. They will give best results with a good manuring of well-decayed stable manure. If it be not well rotted the trouble of getting rid of the weeds from it increases the labour. Failing a supply of the right sort it will be better to use bone-dust or a mixture of superphosphate three parts and blood manure one part.

*Beans, Vetches, and Peas.*—These do best on soils containing lime, and where lime is not available basic slag is best suited to their requirements; in all cases, however, the land containing a natural supply of lime is most suited to a maximum growth. A heavy dressing of superphosphate or basic slag with about 4 cwt. of kainit will give the best results on poor land for peas, beans, or vetches. For sowing peas an ordinary maize drill will answer best. Plant 2 to 3 feet apart. Pea straw contains in its ashes from 35 to 40 per cent. of lime and 12 to 15 per cent. of potash. This indicates the class of soil it requires.

*Sweet Potatoes—Arrowroot.*—So far the sweet potatoes have been somewhat late in maturing, and the crop has not been so prolific. They should be dug and stored in sand for future use. The arrowroot tubers after boiling can be used extensively for pigs. They form an excellent heat and energy-producing food for pigs in winter.

*Sorghum.*—The recent rains, where the sorghum crops are late, will interfere with the operation of converting them into hay. Sorghums of all kinds this autumn have made very satisfactory growth. Where silos are available, they have been converted into chaffed ensilage. That which is not needed for stall-feeding the dairy cattle may be converted into stack ensilage, with every prospect of good results. In the former case, the crop may be left standing for the next two or three weeks to be cut daily as required for the cows.

*Rape.*—This crop is yearly becoming more popular in this district, and its feeding value is becoming recognised. It is evidently replacing several root crops. It is very rapid in its growth, and in favourable seasons is ready for feeding in from twelve to fifteen weeks. It is being especially appreciated for feeding sheep and pigs. This season's crop is well forward, and is ready for forage this month. The most forward variety grown is the Dwarf Essex. When sown in drills, and well cultivated, few crops will act better as a land clearer. It gets rid of weeds. The growth now is very luxuriant and fleshy, and may be eaten down by sheep or pigs when it reaches 6 inches in height. The crops are best where bone-dust two parts, with one part of blood manure, has been used as a manure on light sandy soil. The advantage of eating the rape crop down this month is that a vigorous second crop follows. This naturally depends to some extent on the class of soil and the abundance of moisture. We may now safely predict favourable conditions. Sheep, when eating the first crop, are liable to eat it off too close. This can be avoided by turning them off when they remove the first lot of leaves. They generally eat those first, and return to more closely remove the lower tendrils, leaves, and stems. Horses and cattle will eat rape, but in doing so they injure the plant and retard a good second growth. Further, fresh rape will taint the milk in dairy cattle, which can be avoided by feeding the rape immediately after milking. In every case animals, when very hungry, especially cattle and sheep, eat it greedily, and are liable to sudden attacks of hoven or bloating. It is advisable to break them into feeding it gradually, and after a week's attention allow them free use of the paddock. It is good practice to feed all animals half on grass and the balance on rape. Hoven is more prevalent during wet weather or when heavy dews fall. Whilst on rape, cattle and sheep do best when given free access to rock salt. An average rape crop should feed ten to fifteen sheep to the acre, and fatten them for market in sixty days. A series of tests at Wisconsin and other experimental stations have shown that in pig-feeding an acre of rape is equal to 2·657 lb. of grain. The pigs proved to be more thrifty and in healthier condition when fed with rape than when fed with grain alone. Considerable saving in labour is effected in grazing pigs on rape. Moreover, the ground is enriched from the excreta of both sheep and pigs when fed in this form. The dry matter of rape, from analysis, is proved to contain as much protein, or flesh-forming material, as clover hay. The past season has brought home to many large poultry-raisers the need to substitute green feed of a heterogeneous character for the more expensive nitrogenous food such as bran and pollard. Amongst the most useful of the green feeds for poultry is rape. Repeated trials have fully demonstrated the value of this fodder for poultry.

Mr. G. L. Sutton, Experimentalist at the H. A. College, furnishes the following report concerning experiments with rape :—

The following results, just obtained, in connection with an experiment now being conducted at the H. A. College, will prominently illustrate the great value of this splendid forage crop for alleviating the effects of a drought when the drought has broken. The experiment in question was not conducted with this object in view, nor is it yet completed. When completed the object and results will be published in detail. The crop was planted April 30, 1903. A sowing had been made on the same ground five weeks previously, but germinated so badly, owing to the dry weather then prevailing, that the land was disk-harrowed and resown on the date stated. Shortly after the second sowing the drought broke, the seed germinated well, and within a month there was good grazing for sheep. On May 15, 1903, less than seven weeks from planting, the various blocks were cut for pig feed, and the following computed yields per acre obtained :—

Rape for Greenstuff.—First cutting,, six weeks three days from planting.

| | tons. | cwt. | qr. | lb. | | tons. | cwt. | qr. | lb. |
|---|---|---|---|---|---|---|---|---|---|
| Broadcast ... ... | 11 | 4 | 3 | 16 | Drills, 30 inches apart... | 6 | 4 | 1 | 5 |
| Drills, 18 inches apart .. | 9 | 17 | 3 | 17 | „ 36 „ .. | 5 | 0 | 1 | 22 |
| „ 24 „ ... | 7 | 4 | 0 | 0 | | | | | |

It should not be inferred from these results that broadcasting is the best method for growing this crop in ordinary seasons—they indicate how rapidly this plant grows. Another point of interest to our farmers in the semi-arid districts is, that during the late drought it was observed that the seed of this plant would germinate under conditions too dry for the germination of many other seeds, wheat included.

*Live Stock.*—The unusual supply of rainfall, and its even distribution throughout the autumn, combined with a warmth and absence of frosts, have kept the pastures fresh and green and promoted a luxuriant growth of grass. Consequently live stock are in a fine and healthy condition. On all sides we hear of food supplies for the winter keep of farm stock being abundant. The seed in the early crops have germinated well, and the young plants are well above ground, and are very sturdy. There is strong evidence of early winter green crops suitable for dairy cattle. In point of fact it is generally recognised that despite the dry summer we are better provided for winter feed this season than we have been for the past five years.

# Farm and Orchard Notes.

## RIVERINA DISTRICT.—JUNE.

G. M. McKEOWN.

ALTHOUGH the recent rainfall has had the effect of vastly improving the prospects of the season, it has retarded sowing operations to a considerable extent, so that in many cases late sowing will be absolutely necessary to assist in making up the loss of crops suffered last year. Sowing, however, should be completed with as little delay as possible. Forward crops may be harrowed and rolled where necessary.

*Barley.*—Cape and skinless varieties may still be sown for green fodder in land well prepared and heated with manure.

*Peas.*—The last sowing should be made as early in the month as possible. Yorkshire Hero will be found one of the best varieties. Growing crops should be kept well cultivated by means of horse or hand hoes.

*Vegetables.*—Sow a little carrot, parsnip, radish, lettuce, broad beans, and early white turnips. Transplant cabbage and cauliflower, supplying water as liberally as conditions will admit.

## BATHURST DISTRICT.—JUNE.

R. W. PEACOCK.

THE prospects of the coming season are decidedly encouraging, the beneficial rains of April allowing of the timely germination of the early sown wheat, and also the satisfactory preparation of the land for later sowings.

There are evidences throughout the district of a larger area than usual being put under crop.

The early crops are making satisfactory growth, ensuring the root development which is so helpful when the early summer turns out dry The drought cannot as yet be said to be broken, as there is very little reserve moisture in the subsoil, and a good saturation is needed before the farmers will be satisfied.

Unfortunately the rain came too late to induce much feed in the natural pastures; and owing to the appearance of frosts very little reliance can be placed upon this source for winter feed.

At this farm the American tub silo has been filled with chaffed maize and sorghums; also a stack of ensilage has been erected, comprised of sorghums, rape, and cowpeas.

It was thought that the more succulent rape and cowpeas, when mixed with the sorghums, would allow its packing together more closely and thereby excluding the air, which is the chief consideration.

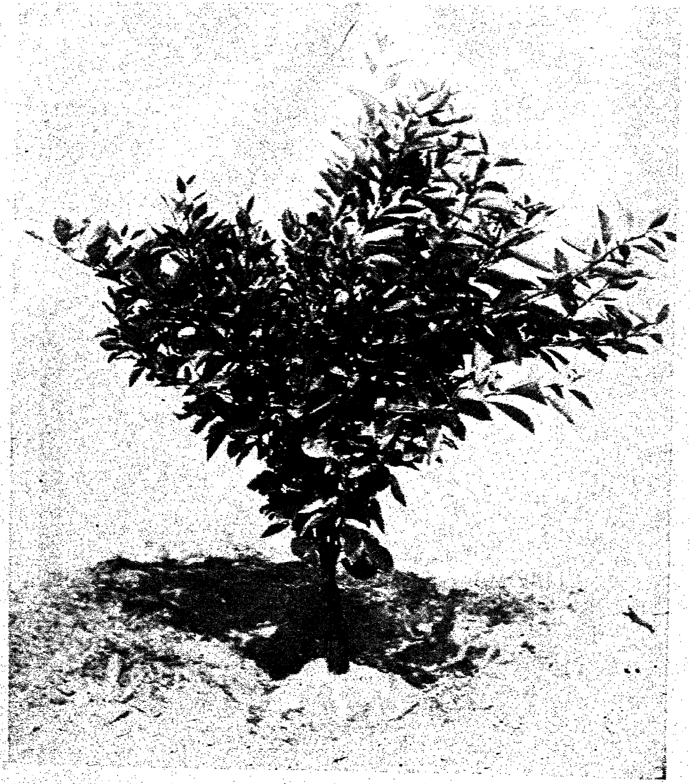


FIG. I

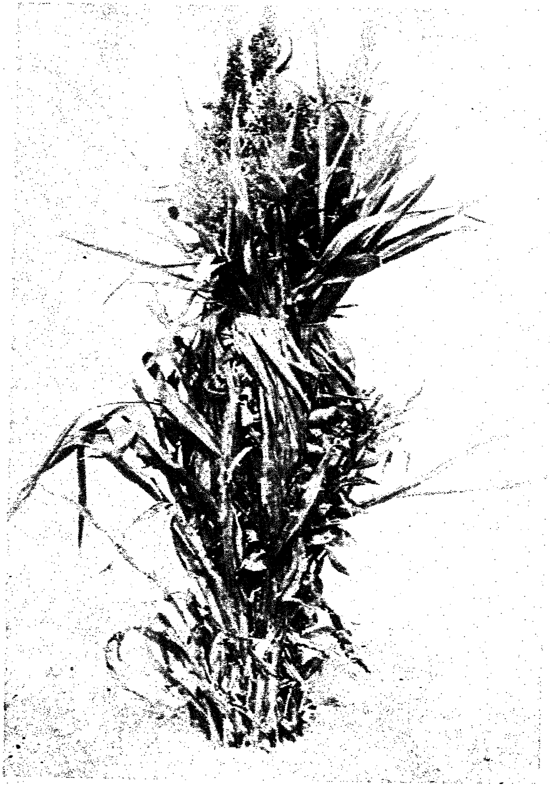


FIG. II.

**Showing Method of Protecting Young Citrus Trees from Frost.** **In the Illustration, Fig. II, sorghum stalks are used, but tea-tree or any kind of**

In those cases where lemon-growers have good cool fruit-houses in which to store fruit, it would be well to experiment to see if they are successful in keeping lemons. They should be picked (cut from the tree) while they are only half ripe, and handled as carefully as eggs. After picking, they should be allowed to stand well exposed in some building until the surplus moisture has evaporated from the skin and the latter has become toughened. This may take from five to ten days, according to the weather.

The sun should not be allowed to shine on them at any time after they are taken to the storeroom. As soon as they are ready to stack away, the room in which they are stored may be well filled, leaving only sufficient room around the outside of the cases to allow of sorting them over occasionally. This it will be found advisable to do every six weeks or two months. The air should never be allowed to strike any of the fruit when once it is stored away, so that it is necessary to stack the fruit close together in the centre of the store, leaving just enough room on the outside for one person to walk around them. Hessian or old bags may be hung around the sides of the stacks, then the tops of all stacks of cases should be covered with boards or trays after the fruit has been covered with bags, so that neither light nor currents of air may find their way into the fruit.

While our coastal climate, owing to its excessive moisture, is not well adapted for the keeping of fruits, still, with careful attention and a careful carrying out of the work, good results may be obtained. If growers would use the common packer with the side out in place of the top, and after putting paper in the case place about two layers of lemons in each case, and stack about 200 cases close together in each stack, these cases could then be used later for marketing the fruit in.

All refills in deciduous orchards should be completed this month, and wherever orchards are very large the pruning may be commenced; otherwise July and August are two of the best months for doing this work. It is always best to have this completed, so that the prunings may be removed and the winter's spraying and ploughing completed early in most districts. A Handbook on Pruning can now be obtained from this Department at the cost of one shilling.

## EXPLANATION OF COLOURED PLATE.

*Reinette Jaune Hâtive.*—One of our best early apples. Tree vigorous and spreading, carrying a large crop; fruit medium size, striped with red and yellow; skin smooth and shiny; stalk short, inserted deeply in cavity; calyx closed in a rather broad, shallow basin; flesh whitish-yellow, crisp, subacid. Ripens in January.

*Stone Pippin.*—A well known and popular English variety which is largely cultivated in Australasia; fruit medium to large, roundish conical; skin pale green, sometimes with a brownish-red tinge on the cheek; flesh greenish-white, firm, crisp, juicy, with a pleasant subacid flavour. Ripens late, will keep for a very long time, and is a first-class cooking and dessert variety; also a good variety for exporting, and one of the most popular kinds for our local market. Tree upright in habit, vigorous, hardy, and a very free bearer.

1
2

# Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

## DIRECTIONS FOR THE MONTH OF JUNE.

### Vegetables.

So far, at time of writing towards the end of May, the season, since the drought has broken up, has been very favourable for the growth of vegetables; indeed, in some parts of New South Wales the growth of some kinds has been remarkable. Probably the season will continue to be satisfactory during June, and the sowing and planting of all seasonable kinds should on no account be neglected. In the cold districts, except the very coldest, some kinds of cabbage are likely to succeed very well, and sometimes frost improves them. The Savoy and Brussels sprouts, and also the seakale, although not exactly a cabbage, should be grown, and instead of lettuce, try the endive, an excellent substitute which is likely to succeed where the lettuce would fail.

When laying out a new vegetable garden arrange so as to keep the permanent vegetables, the globe artichoke, the asparagus, and the rhubarb by themselves. With these, or rather near them, some strawberries could be planted, unless it be preferred to plant these useful fruits as edgings to the footpaths, but when used in this way they are sometimes more likely to suffer from a dry season than if planted in a bed to themselves.

With the exception of strawberries, which should be planted at once, if not already set out, the permanent vegetables need not be planted until the winter is nearly over, but the ground should be made ready for them. Use abundance of farm-yard manure, unless the soil is naturally rich, when it may not need the application of any at all. Make the beds so that water is not likely to remain in them, but do not elevate the surface to any great extent if at all above the surrounding surface. Trenching would, of course, make a bed very much higher than adjoining untrenched land, but if you trench, trench the whole garden, footpaths and all, and then no one part will be more elevated than another, and all will be equally drained.

*Artichoke, Globe.*—May be planted now, if desired, but there need be no hurry about it. Either suckers or rooted plants may be used. Plant 3 feet or considerably more apart, for if the soil is rich the plants will probably grow to a considerable size.

*Artichoke, Jerusalem.*—The tubers of this plant, which is quite different to the above, have been ready for use for some time. They are rather difficult to keep good when dug up, and the best way to manage with them is to dig as required. When digging them up take out every little bit, for anything left in the ground will most likely